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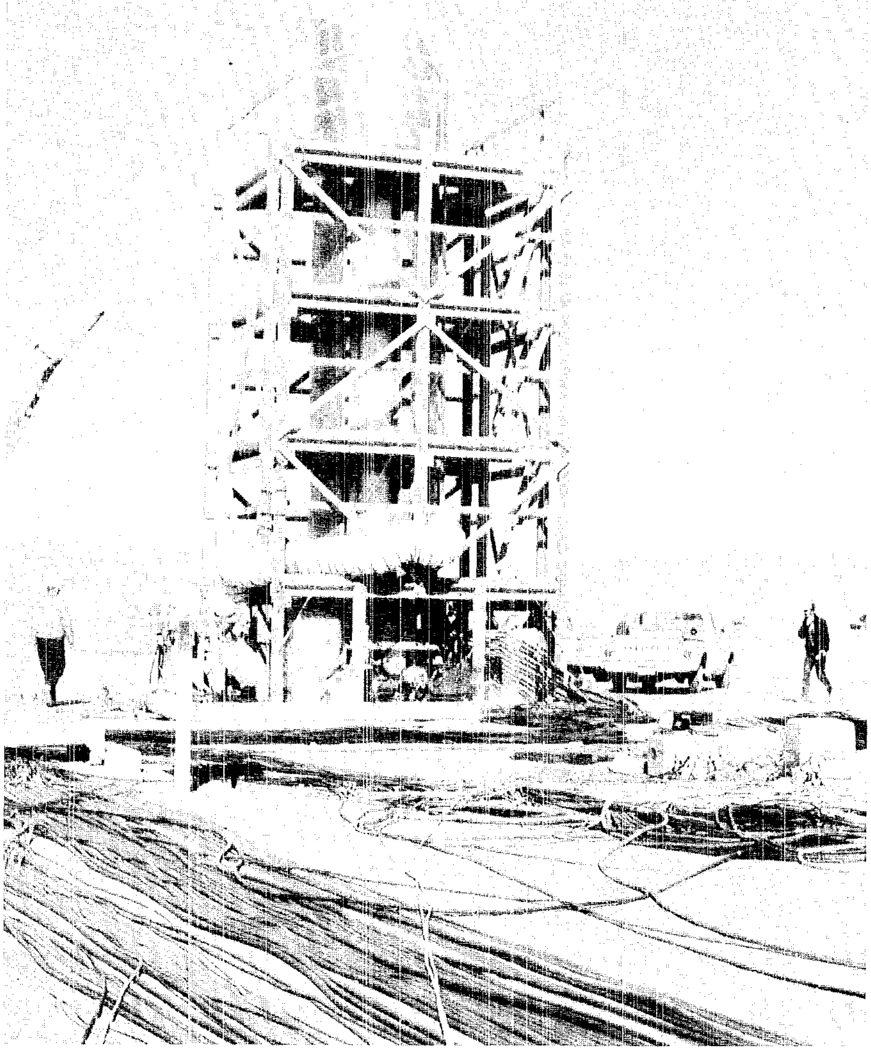
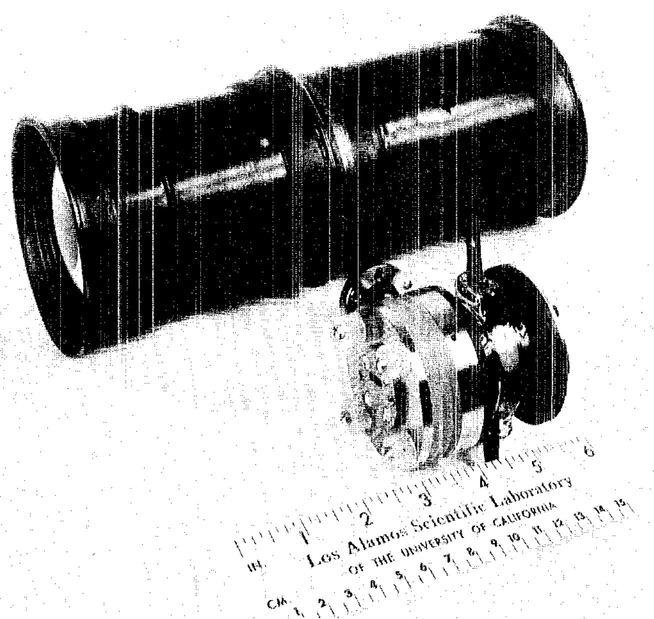
Cover

"Dial-a-Pellet" is what ISD-1 photographer Bill Jack Rodgers whimsically, but not inappropriately, titled the cover photo that he made of a rotating laser-fusion target mount while photographing the article beginning on the opposite page. The tiny microspheres are the gleaming points at the end of the "needles" jutting out from the mount. The mount successively rotates the targets into a position where converging laser beams will compress the targets. The device saves time in conducting a series of laser-fusion experiments.

The photo was exhibited at the recently held 17th annual Industrial Photographers of the Southwest Conference in Albuquerque. LASL photographers Rodgers, Gene Lamkin, L-4, and Dana Schneider, Bob Martin, Matt O'-Keefe, and Henry Ortega, all ISD-7, won 16 of 18 awards.



Both the monstrous and the minuscule in cameras share a common capability: ultra-high speed. The giant camera at the Nevada Test Site, above, takes frames at the rate of billions per second, while the small streak camera below takes x-ray photos with resolution to trillionths of a second for laser-fusion experiments. The dark, larger camera above it is a commercial model shown for comparison.



The Fastest Cameras in the West

The quest for speed has always been one of man's more exciting endeavors and one which is by no means limited to striving for records in planes and cars. The quest extends to science, too, where investigators seek ways to take photos of events occurring in extremely short time periods.

Speed in photography has advanced steadily since 1839 when exposures for the original Daguerrotype process were measured in minutes. Some 40 years later, advances in optics and emulsions had reduced a typical outdoor exposure to 1/25th of a second. Today, amateurs routinely take snapshots at speeds to 1/1000th of a second.

At faster speeds, mechanical shutters begin experiencing difficulties. Very-high-speed cameras for laboratory and industrial uses incorporate rotating disks, plates, drums, or mirrors. Because these whirl rather than jerk, they can make exposures at speeds of up to millionths of a second.

But shorten the exposure by a factor of a thousand—to billionths of a second—and these devices also approach their physical limitation, one being the stresses generated by centrifugal force. Thus, for ultra-high-speed applications, moving parts must be eliminated entirely. Instead, exposures are made electronically with triggering that relies on the very short distances light or electricity travels during the very brief time periods involved.

To appreciate the times and distances involved, consider that light would travel around the world more than 7 times in a second; from Los Alamos to Albuquerque and back in a millisecond (a thousandth of a second); from the Administration Building to the Physics Building in a microsecond (a millionth of a second); the length of your forearm in a nanosecond (a billionth of a second); and the thickness of your thumbnail in a picosecond (trillionth of a second).

It is in the realm of nanoseconds and picoseconds that a small group at Los Alamos Scientific Laboratory has achieved notable advances in ultra-high-speed camera design, in the process creating what they like to call "the fastest cameras in the West."

For underground tests at the Nevada Test Site, they created what is also the largest camera in the West, a 3-story apparatus capable of taking "movies" of underground nuclear detonations at the rate of two hundred million frames a second.

And, in startling contrast to this behemoth, the same team has recently created not only the fastest x-ray streak camera in the world, but one which is also very small. It takes streak photos with resolution to a few picoseconds and is so compact you could slip the camera into your coat pocket. It represents a striking exception to the general principle that the greater the resolution required, the bigger and more elaborate your laboratory equipment must be.

Underground Movies

Like many of LASL's scientific and technological achievements, the development of faster, better, ultra-high-speed cameras received its impetus from the weapons program. For a nuclear detonation in 1969 at the Nevada Test Site, investigators wished to make "slow-motion movies" measured in nanoseconds. Al Lieber, Dean Sutphin, Clint Webb, John McGurn, and Tom O'Hare, all assigned to J-Division at the time, came up with a concept that did the job.

The requirements for the camera included the capability of recording 6 images, at intervals of 10 nanoseconds, of the neutrons produced during the detonation. Conveniently, nature provided a way to trigger the camera. Neutrons, being particles, travel considerably slower than gamma rays, which travel at the speed of light. Thus, to trigger the camera, the LASL researchers simply placed a gamma-ray sensor in the line-of-sight path to the detonating device. This reacted to the gamma rays in ample time to activate the instrument to record the slower-paced neutrons upon their arrival.

To form images of the neutrons, a fluor (a device that reacts by emitting light) was placed in the neutron stream. The fluor flashed light signals to 6 image intensifiers tripped in sequence. These images in turn were reflected by a 6-sided mirror so that all were focused onto a single image-orthicon tube (the same type of tube used in TV cameras). The final result was a single "print" of the 6 images.

It was in separating these images in time that the LASL team ingeniously exploited the time it takes electricity to travel a given distance in a coaxial cable. Since it takes electricity 10 nanoseconds to travel 2 meters in cable, varying the lengths of cable between the image intensifiers and the control unit by 2 meters created the desired 10 nanosecond intervals between images.

A Super Movie Camera

The camera for the 1969 Nevada shot was placed downhole and, along with other diagnostics, was destroyed in the experiment. What remained was valuable know-how then used to build a second camera for x-ray photography that was not only faster, but also provided greater resolution, for a 1972 shot at the Nevada Test Site. Unlike the camera for the 1969 shot, the camera for the 1972 test posed a knotty problem in triggering.

While the earlier camera had "advance early warning" from gamma rays to trigger exposures for neutrons, the new camera would have no such advantage because it had to take photos of the x radiation itself. How does one take a photo of a pulse of x rays when the pulse itself must act as the trigger? By the time the mechanism is activated, the x radiation is long gone.

The solution was ingenious—and a major reason why the final design became a "supercolossal movie camera," even by Hollywood standards, towering 3 stories high. A small sensor is placed in the line-of-sight channel near the control unit so that the electric pulse from it would have but a very short distance to travel to the control unit. The x-ray pulse generated by the detonation trips the sensor in passing and then travels to the top of the camera 5 meters distant. There the x rays strike fluors that, in turn, send visible blue-light signals back down towards the camera. By now the camera has had time to become activated in the 30-nanosecond interval that it takes for this transaction to occur. The light strikes an array of lenses, image intensifiers, and TV cameras, and images are recorded electronically.

In addition to the camera's impressive speed and accuracy, image resolution is considerably greater because each image is enhanced and recorded by its own "private" system. But, the basic method for triggering the exposures in sequence is the same as it was for the earlier shot where coaxial cables of different length were employed. Since the intervals between exposures was only 5 nanoseconds, as compared to 10 nanoseconds for the 1969 camera, the differences in lengths between the cables were reduced to 1 meter.

Although the 1969 camera was destroyed during the test, the 1972 camera was designed to be a permanent part of the diagnostic inventory at the Nevada Test Site. It is positioned above ground and moved away from ground zero after detonation.

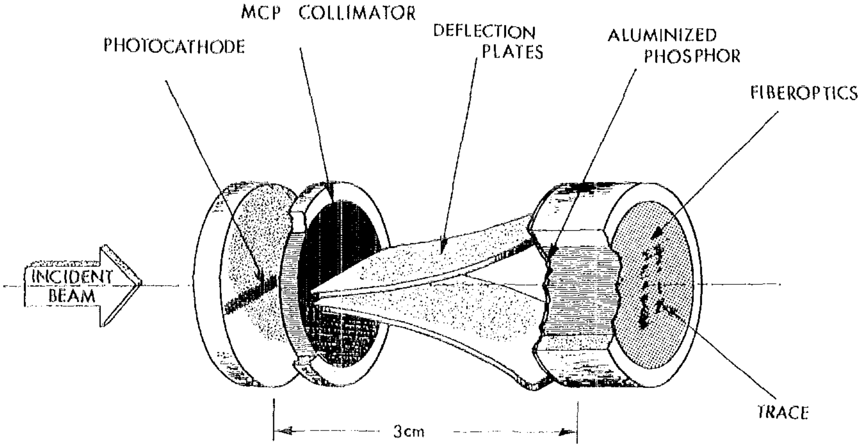
Super Streaker

Turning their talents from the monstrous to the minuscule, Lieber, Sutphin, and Webb transferred to Group L-4 and began applying their specialized know-how to the development of streak cameras for L-Division's rapidly growing laser-fusion research program. Such cameras would have to photograph tiny microspheres being compressed by converging laser beams, an event measured in units of time 1000 times briefer than nanoseconds: picoseconds.

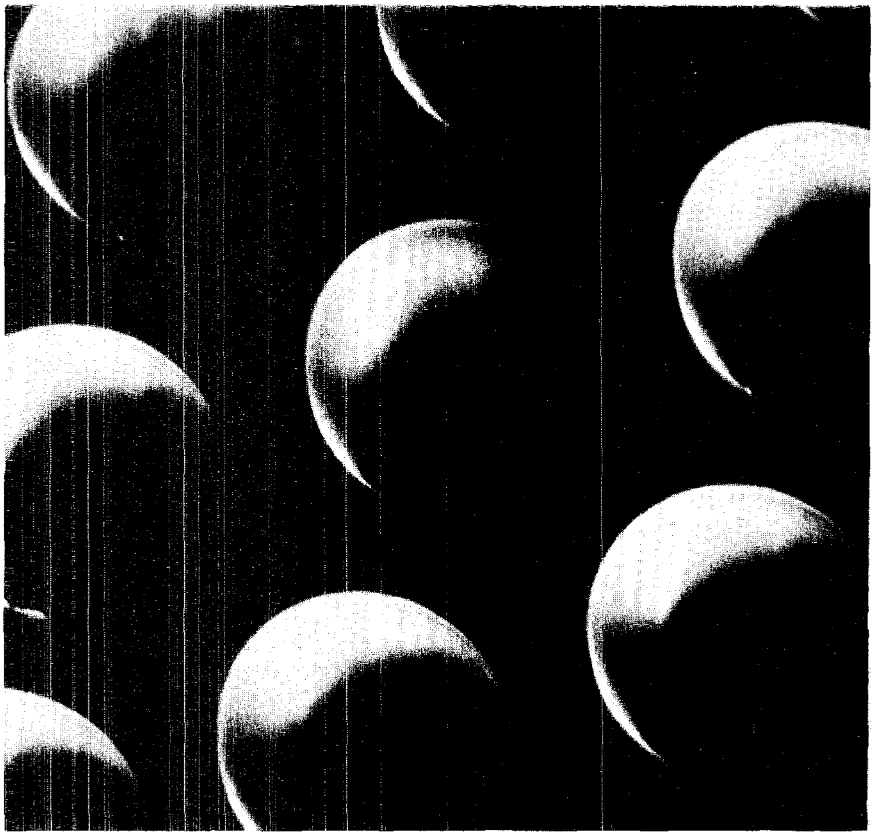
Streak cameras, rather than recording literal images as do conventional cameras, record streaks (the British call them smears) of an event over a period of time. In the final stage of a streak camera's operation, an electron beam is swept over the face of a cathode tube, just as in a TV receiver, creating a record of the event as a streak of varying width, brightness and other characteristics. The phosphors on the face of the tube glow long and brightly enough for the image of the streak to be recorded on ordinary 35-mm black-and-white film. Investigators can easily read the streak to learn just what was going on at any given point in time.

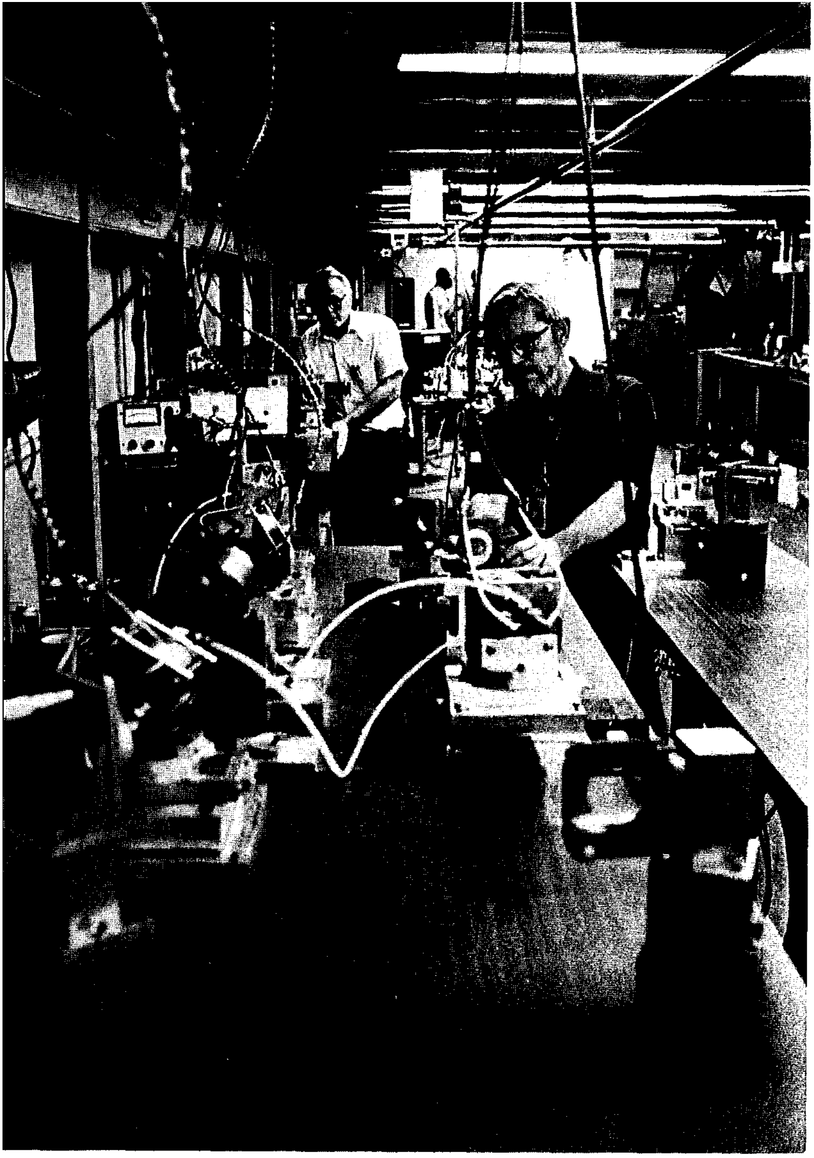
Sutphin built several large streak cameras that proved to be superb and reliable instruments, one of which was used by Stanley Shapiro and Anthony Campillo, both L-2, to record photosynthetic reactions in experiments conducted jointly with Victor Kollman, H-11 (*The Atom*, May-June 1975).

But as the laser-fusion program grew in scope and complexity, so did the need for an "ultimate" camera—one which would be quite compact so that it would not crowd out other diagnostics in the target chamber. And it would have to record with high resolution a reaction that takes place in but 25-30 picoseconds as laser beams compress a microsphere, which then explodes.



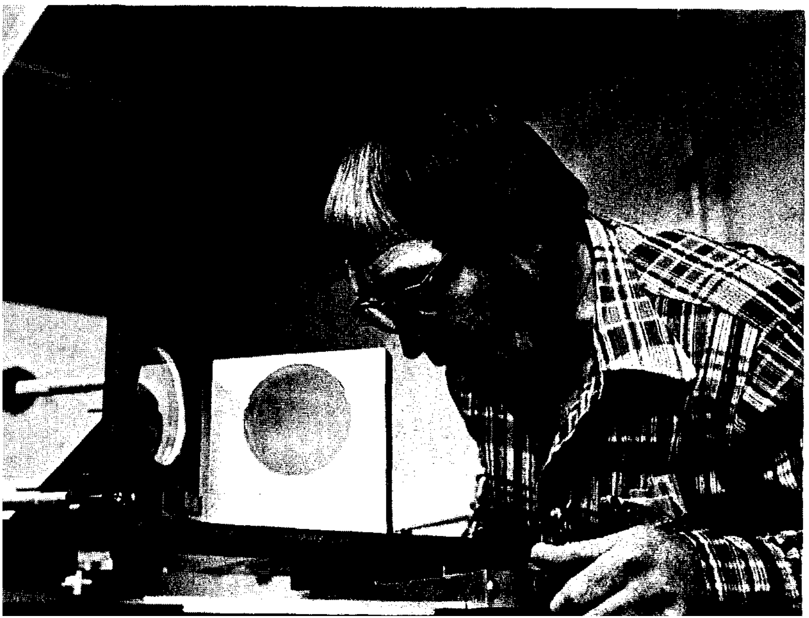
A simplified diagram of the Pico-X streak camera, above, shows a fundamental design difference indicated as MCP (Microchannel Plate) collimator. Electrons from the photocathode flow through millions of tiny parallel tubular channels rather than through a single pinhole as in conventional streak-camera design. Below, a microchannel plate is shown at a 3000-times enlargement.

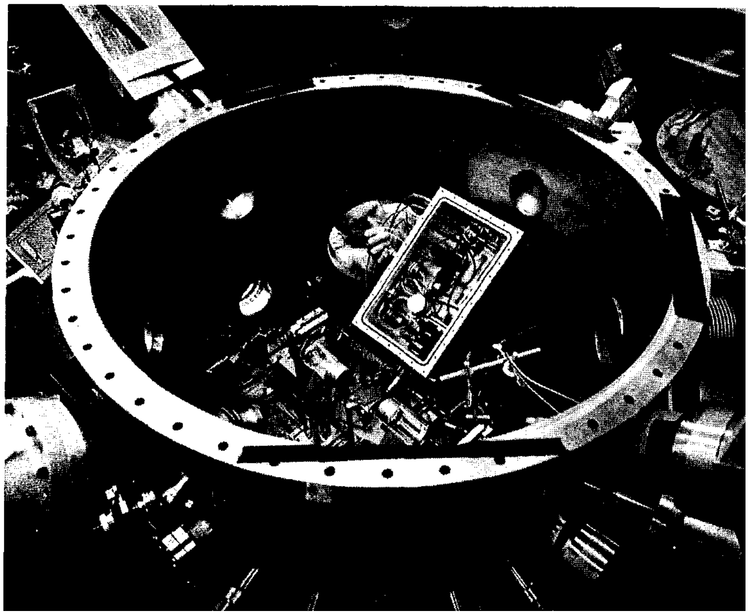




Clyde Reed, left background, and Dick Robertson, right foreground, both L-4, "play the trombone" at TA-35. By moving mirrors, the path laser light takes to trigger a streak camera is lengthened or shortened, thus altering the shuttering. Below, Dean Sutphin, L-4, moves a mirror a few millimeters to adjust the length of the path to the target.

Above, Al Lieber and Dean Sutphin, both L-4, check the Pico-X streak camera before an experiment. The target chamber is in the background. Below, Clint Webb, L-4, connects wiring to the camera that is in a case that, in turn, is in the target chamber. During operation, a vacuum is formed in the case.





In designing such a camera, the LASL team had to contend with a problem that, while manageable in larger, slower streak cameras, threatened to make the "ultimate" camera impossible to build unless a completely new approach could be discovered. The problem area was the pinhole through which electrons, "knocked out" of a foil by photons of light, had to flow so that they could be focused into a beam that swept across the face of the "TV tube." In effect, a severe "traffic jam" develops among the electrons attempting to pass through the pinhole as their charges begin to affect each other. Resolution is diminished and "noise" builds up.

The answer lay in a remarkable product of American technology: microchannel plates. These resemble honeycombs, on a microscopic scale, except that the cross section of passages through the thin glass plate is circular rather than hexagonal. In their manufacture, glass tubes in a bundle (typically 9 inches in diameter) are repeatedly heat-softened and drawn down to a rod no thicker than a pencil, the cross section of which contains millions of tiny channels per square centimeter. Their most dramatic use was as essential components of image-enhancement devices for night weapons in the Vietnam war. The LASL team was familiar with them because they had used them for image enhancement in the Nevada Test Site cameras.

Although the investigators had already planned to use a microchannel plate for image enhancement where the streak is formed, its new use to solve the pinhole problem came to Lieber's mind as he drove along a freeway in New Mexico.

As Lieber recalls, "As I drove along, I noticed a series of small culverts under the opposite roadbed. Having little to occupy my time and thoughts, the culverts reminded me of microchannel plates and I began thinking of them. We had just begun to tackle the design problems of the 'ultimate' camera and it occurred to me that by replacing the single pinhole with a microchannel plate, the 'traffic jam' at the pinhole would be eliminated as small numbers of electrons flowed through each of millions of tubules and that these electrons would be collimated to achieve the necessary focus."

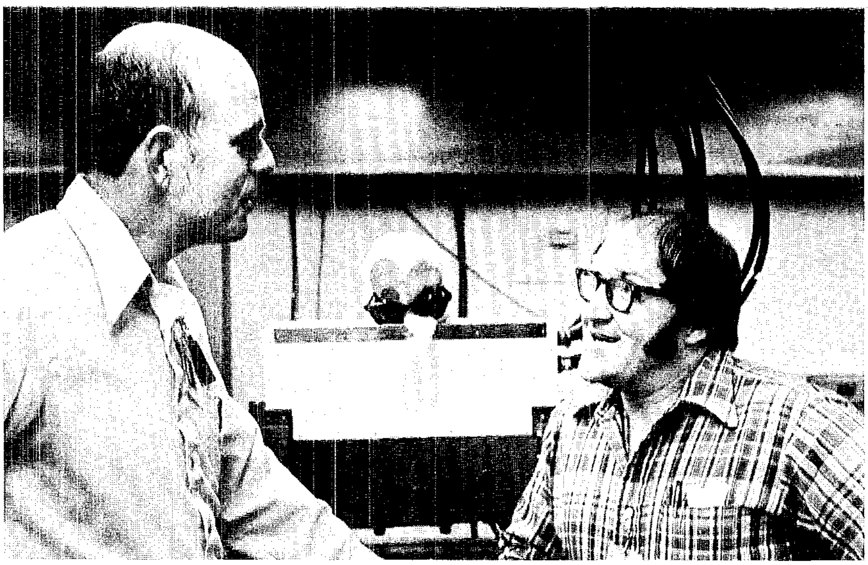
After Lieber consulted with his colleagues, the team decided to incorporate the novel application of the microchannel plate into the "ultimate" camera, now named the Pico-X camera, and this usage became a fundamental part of the patent application for the camera.

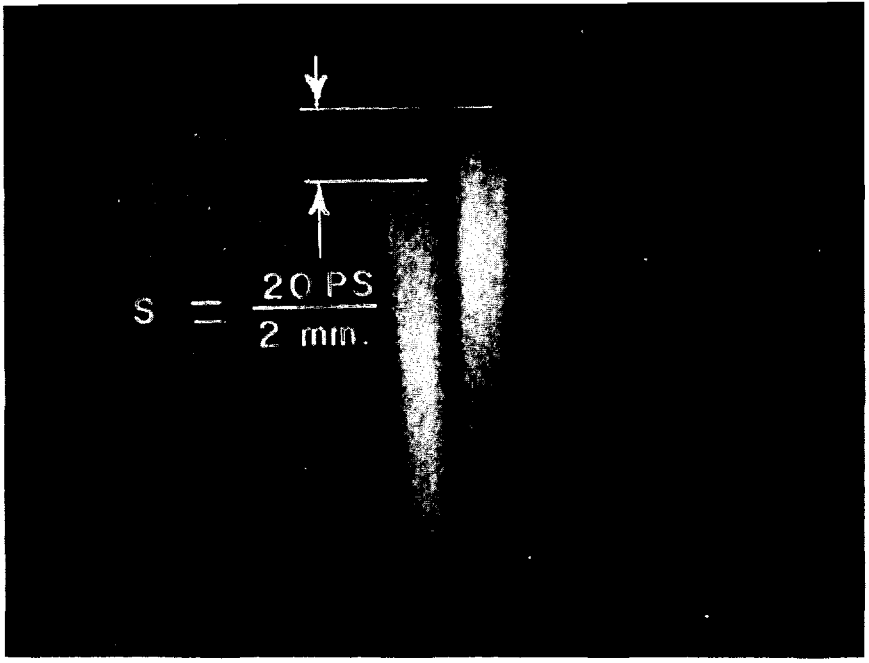
Among other advantages associated with the microchannel plate is that it substantially reduces the need for other components, leading to the Pico-X camera's extreme smallness. Even when enclosed in its larger vacuum box, the complete assemblage is acceptably compact for placement with other diagnostic instruments within the target-chamber "kettle" where laser-initiated implosions of microspheres take place.

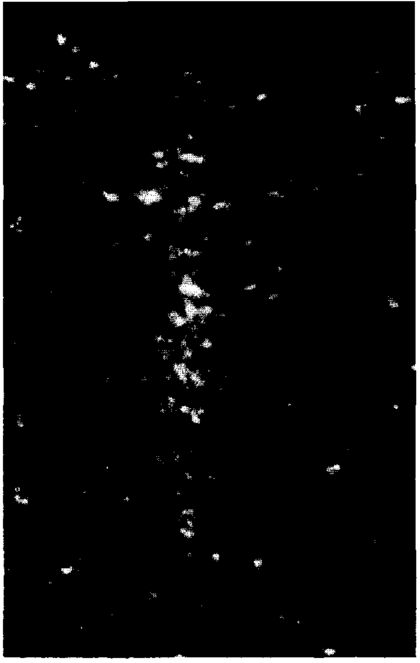
Sliding the Trombone

The geometry of mirrors and lenses used to channel laser beams from the neodymium-glass laser to the kettle-like target chamber at TA-35 is impressive and bewildering. The single pulse—70 picoseconds long—is split, reflected several times, channeled through holes

Lieber and Sutphin talk over problems of laser-fusion diagnostics, unaware that the "laser bug" is eavesdropping. The laser bug, wearing appropriate safety glasses, is a "mascot" symbolizing the unexpected difficulties often encountered in intricate laser-fusion experiments.







Two photos by the Pico-X streak camera reveal important information. At left, the 2 streaks shows a difference in time of 20 pico seconds between the arrivals of 2 laser beams. Experimentalists use data like this to adjust length of paths for the beams. At right is a recently made record of the compression and blowing apart of an empty microsphere. From top to bottom, the ball is being compressed, then blows apart (upper "bulge"). To the experimentalists' surprise, the sphere then recompressed and began coming apart a second time—a phenomenon that will now be investigated. The time shown in the photo is 30 to 40 picoseconds.

in the walls, and is focused onto a speck-like microsphere within the target chamber after traveling a distance of 50 meters.

To give the Pico-X camera a few picoseconds to "warm up" for the subsequent x-ray pulse to be generated by the laser implosion, a small section of the laser pulse is "bled" from the beam and directed over a shortcut to activate the camera. To adjust the delicate timing of this triggering pulse, members of Group L-4 have devised an array of mirrors resembling the slide of a trombone. And, like a trombone, moving the slide changes things. By moving 1 mirror in the "trombone" a few millimeters or so, the path of the triggering pulse can be lengthened or shortened, changing its arrival time at the Pico-X camera accordingly.

Investigators are now using the Pico-X camera to take a good look at the assembly (compression) of the microsphere, which takes place in 20-25 picoseconds, and at a subsequent period when fusion occurs, which takes place in 5 picoseconds. One of its first, and still frequent, applications is synchronizing the arrival of the 2 laser beams at the target. By recording 2 streaks—each generated by one of the split beams—any difference in relative positions of the 2 streaks can be measured to calculate an adjustment in one beam or the other. This is accomplished by moving one mirror or another a few millimeters.

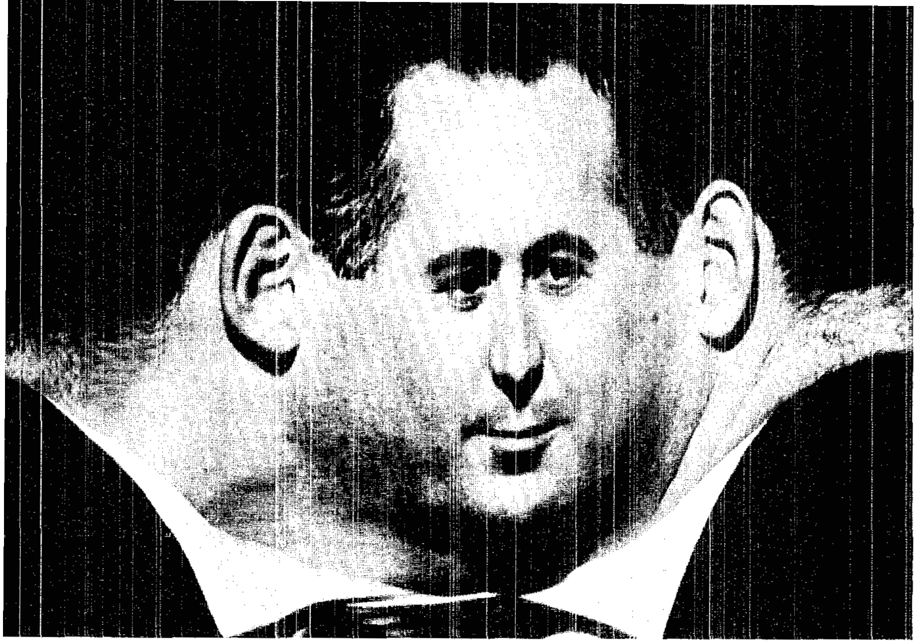
Is Pico-X The Ultimate?

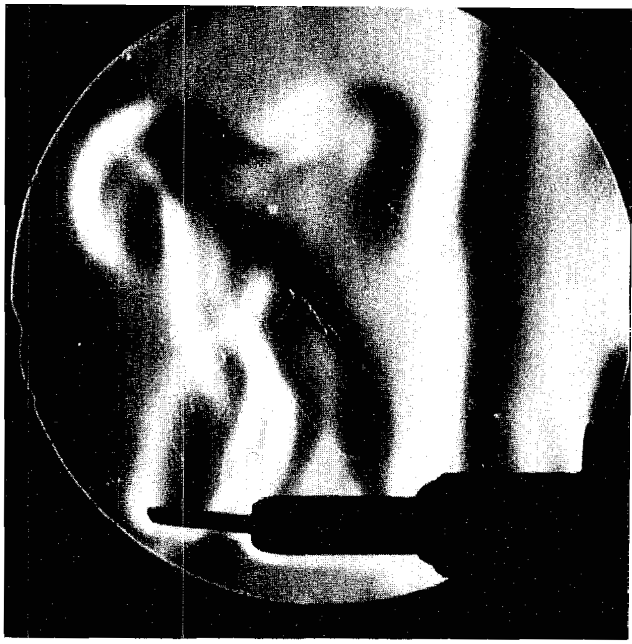
Commenting on prospects for further increments in speed in Pico-X-type cameras, Lieber says, "We feel sure that with a few technical refinements, we can achieve x-ray resolution in Pico-X to about 0.6 picosecond, which is at least 30 times better than you can get with commercial units. It's always risky to say you've reached the limit in science—so often somebody comes along behind you with a breakthrough that moves the limits back.

"Yet, it looks to us as if we are approaching limitations imposed by the laws of physics themselves. One is Heisenberg's Uncertainty Principle, which says that as you get down to very fine measurements, the interference of the measuring instruments begins to introduce increasingly severe inaccuracies. Another is that as you get down to pulses whose lengths are only a few wavelengths of the photons themselves, you don't have much to work with," Lieber adds.

Nevertheless, if a need should arise for a faster camera, and if a way can be found to build one, chances are LASL's builders of ultra-high-speed cameras could find it. After all, they've already built the fastest cameras in the West.

Three times.





. . . more on photography

Among the fringe benefits enjoyed by Los Alamos Scientific Laboratory employees is the opportunity to participate in LASL-sponsored seminars and workshops conducted by experts from universities, industrial laboratories, and other technical entities.

From April 5 through 10, a seminar on photographic science, coordinated for LASL by Ray Morrison, PER-5, and Jim Kearns, M-2, was presented at Fuller Lodge by 9 Rochester Institute of Technology professors to some 90 LASL employees. That the seminar was so heavily attended is understandable inasmuch as photography is an essential research tool for many LASL technical groups.

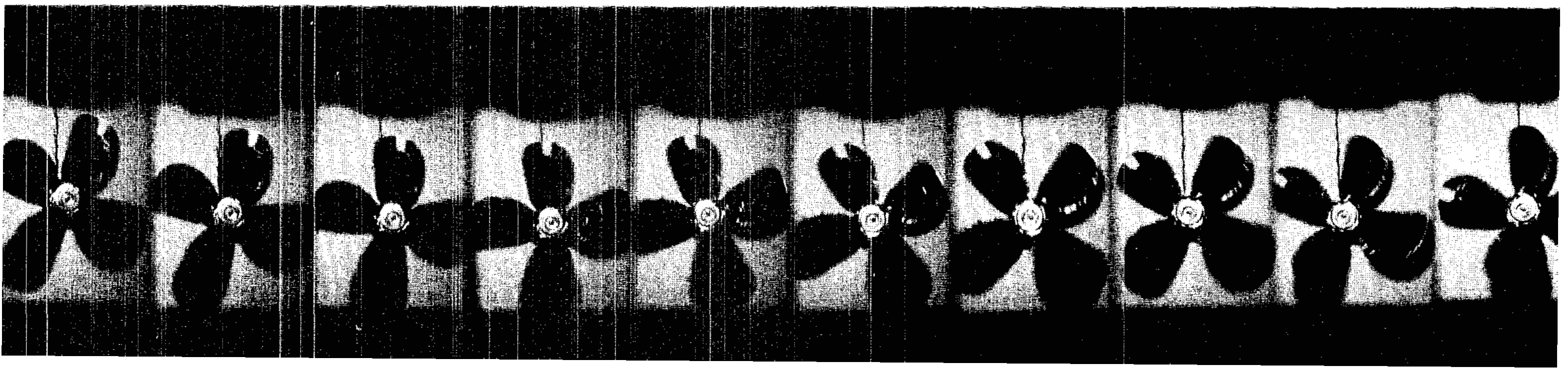
For 5 days, the attendees knuckled down to learning advanced concepts and technical aspects of such subjects as sensitometry, photographic chemistry, instruments, image evaluation, and nonsilver photographic processes. But occasionally the participants were intrigued and, sometimes, amused by "far-out" samples of photographic techniques such as presented on this page.

The disk-shaped image was made by schlieren photography, a technique relying upon the diffraction of light passing through gas or liquid of varying density. The horizontal object at the bottom of the "porthole" is a hot soldering iron; the whorls above it are of hot air. The pattern of the rising hot air, less dense than the surrounding cool air, was made photographable by a beam of light focused through a "knife edge."

The "squished" man's head was made by periphotography, a technique used to take 360° photos of objects such as cylinders. The subject is placed on a "lazy susan" and rotated in synchronization with the slit of a focal plane shutter passing across the film plane. You might enjoy cutting out the photo, rolling it into a cylinder, and seeing how the grotesque features become normal again.

The photo that looks like a collection of 4-leaf clovers is really printed from a negative of a whirling fan blade made by "poor man's high-speed framing photography." This technique also relies on a focal-plane shutter. The fan is set up in the vicinity of the camera and 10 mirrors are positioned so that the reflections of the fan are seen by the camera. The exposure may be made with an ordinary 35-millimeter focal-plane camera set at a high shutter speed. As the focal-plane slit moves across the film plane, it records the image in each mirror in sequence for an effective framing speed of 600 frames per second.

This is photography you can do at home, but please don't ask Morrison or Kearns what you can do with the 10 extra mirrors after you're through.



Treadmill to Safety and Health

Upstairs at Fire Station Number 1, opposite the Administration Building, they're "torturing" men on a treadmill. But they're doing it for safety and health (and the men are willing volunteers).

Group H-5's respirator section has long investigated respirators (*The Atom,* January-February 1976) and knows a great deal about them. What they don't know a great deal about is the effects of respirators upon the performance of people wearing them, especially persons under stress, such as men fighting a fire. For instance, how much will the weight of a self-contained breathing apparatus on a person's back impair his performance? What stress does the respirator with full facemask place on the wearer?

Running volunteer subjects on a treadmill to exhaustion while wearing a respirator such as the 40-pound Scott Air Pak may provide new and valuable information to reduce risks for persons wearing such equipment during an actual emergency. The findings will be of great interest, not only to the Los Alamos Fire Department and Los Alamos Scientific Laboratory groups which may use such equipment, but to organizations around the country who are concerned with respirator use.

But safety is only half the story. The other half is health, including yours.

Physicians recently have become aware that stress testing is a valuable addition to physical examinations. Tests made of a patient at rest may not reveal certain heart, blood-vessel, and respiratory dysfunctions that would show up if the patient were exerting himself.

Which is why Group H-2 (occupational medicine) is equally involved with the Group H-5 respirator section in the pilot project. Although a great deal of useful information is expected from the pilot project, its main purpose is to develop standards and procedures for more extensive investigations in the future.

The project began in January with the screening and complete medical evaluation of likely volunteer male subjects between 25 and 40 years of age. Twenty subjects were selected and began participating in a training program to accustom them to walking and trotting on a treadmill and to wearing a breathing apparatus.

In March, actual tests began with subjects being first examined at rest to establish data bases. Then, with leads to EKG (electrocardiograph), temperature recording, blood-pressure measuring and other equipment attached to their bodies, subjects walked and jogged on the treadmill as their bodily functions were monitored continuously and recorded. After their workouts, subjects were examined again to measure aftereffects.

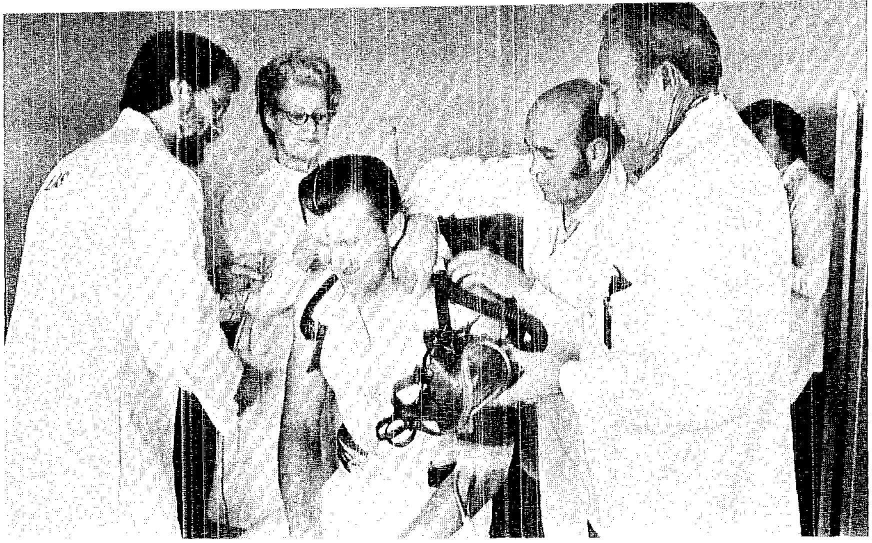
Through May, tests were conducted at the rate of 4 per day. Sometimes the subjects wore no equipment. Other times they wore equipment, but not the face mask. And other times they wore the face mask in place and breathed through it. "We randomized the sequence of wearing equipment to eliminate from our data any improvement in performance by a subject as he became more skillful on the treadmill," Tom Davis, coleader of the project for Group H-5, explains.

Testing was completed by the end of May, and the data is now being analyzed for inclusion in a report to be issued by the end of June.

During the test itself, an increasing load is imposed on the subject by inclining the treadmill at steeper angles and increasing its speed. From 8 to 12 minutes on the treadmill is the limit of endurance for most subjects, after which signs of fatigue become evident and the test is stopped. Keeping a watchful eye on both the instruments and the subject—lest tripping, some mishap, or medical symptoms call for a fast treadmill turnoff—is Group H-2 physician and project coleader Charles Shafer and H-2 nurses Eudena Boyles, Jean Ryan, and Ida Antos.

Aside from its interest in the project itself, Group H-2 has something else in mind, and it may involve you. "We hope to add stress testing to our examinations in the future for selected employees, contingent upon adequate staffing and facilities. Selected employees would be those in high-risk positions who, in the event of physical failure, may endanger themselves or compromise the safety of others. Or, they could be those who are heart-attack risks and otherwise would not know it. These include those with certain combinations of high blood fats, tendency to diabetes, high blood pressure, excessive smoking, sedentary life style, and a family history of premature heart attacks. Should an examination show such conditions, we might prescribe either a maximal 'to-the-limit' test or a submaximal test that stops short of exhaustion," Shafer says.

Maximal or submaximal, when stress testing does become available, a word of advice may be in order. If you're still smoking, quit. And if you receive an invitation to a party that you know is going to be a late one on the night before your physical, it might be a good idea to decline with regrets.



Left, Jim Trehern, ERDA fireman and a volunteer subject, has monitoring and respirator equipment placed on him by, left to right, Tom Davis, H-5; Eudena Boyles, H-2; Jose Bustos, H-5; and Charles Shafer, H-2. Center, Trehern "gives it his all" on the treadmill. Below left, Trehern's post-test exhaustion is evident to Bustos who begins to remove equipment. Below right, Davis and Jean Ryan, H-2, read data from the test.

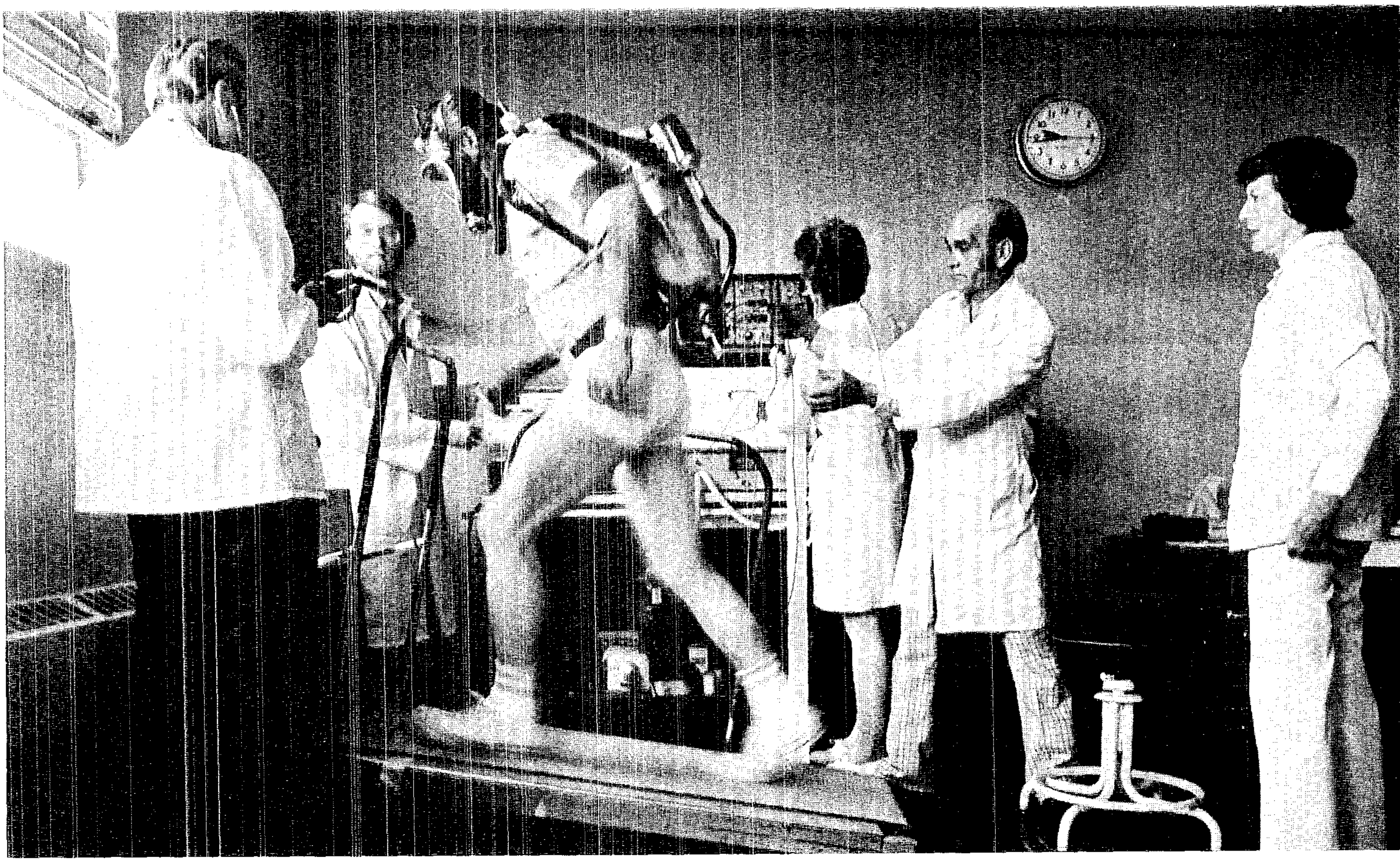
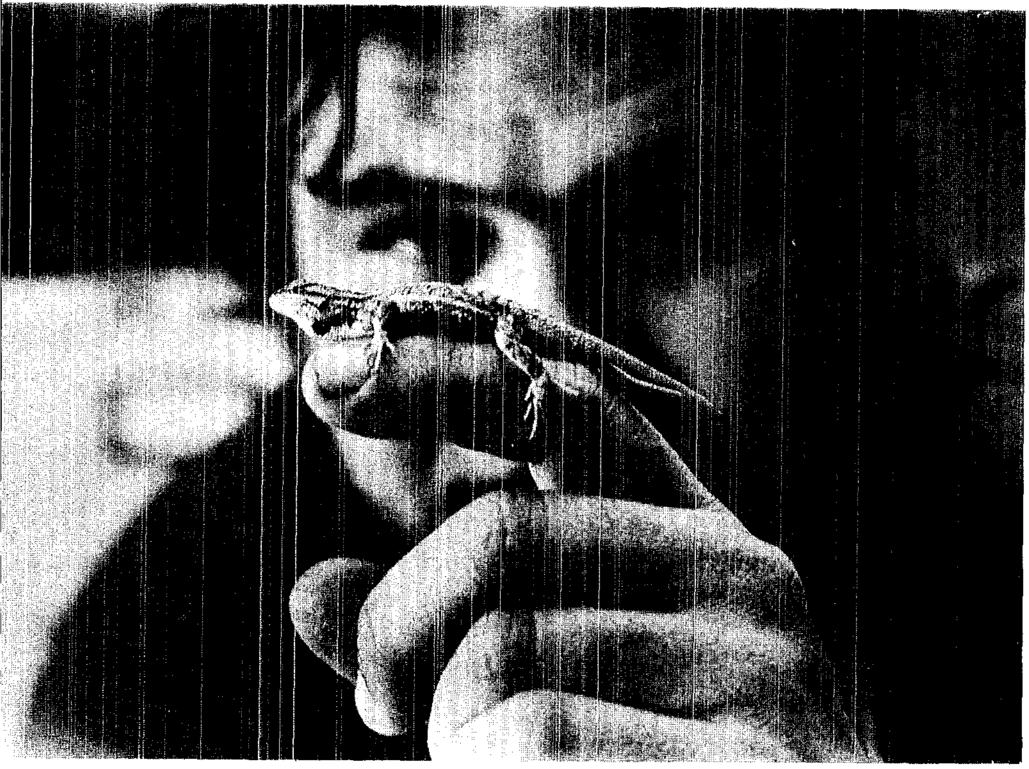
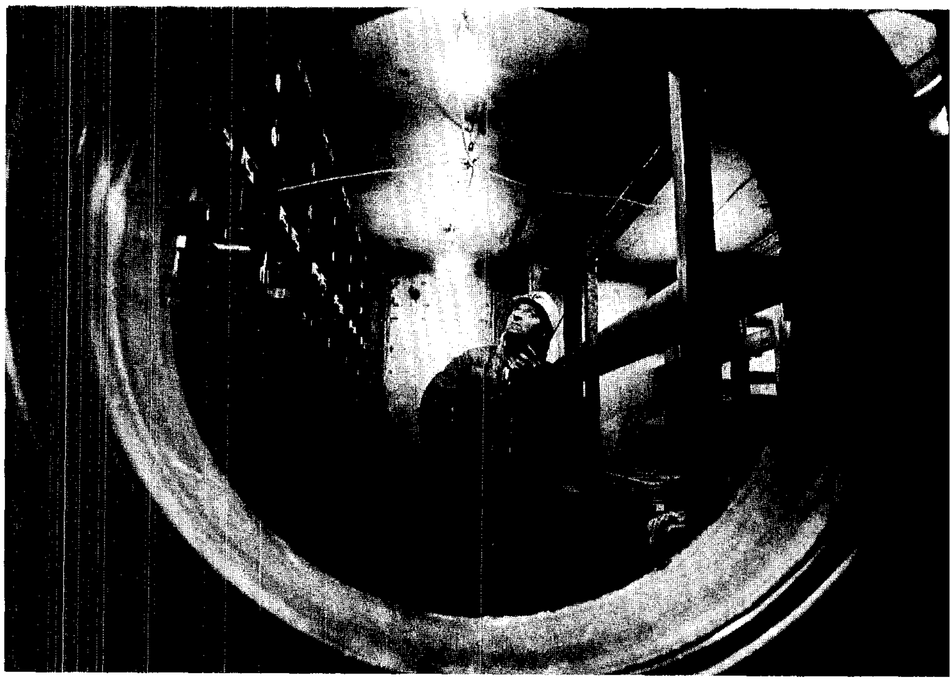


Photo Shorts

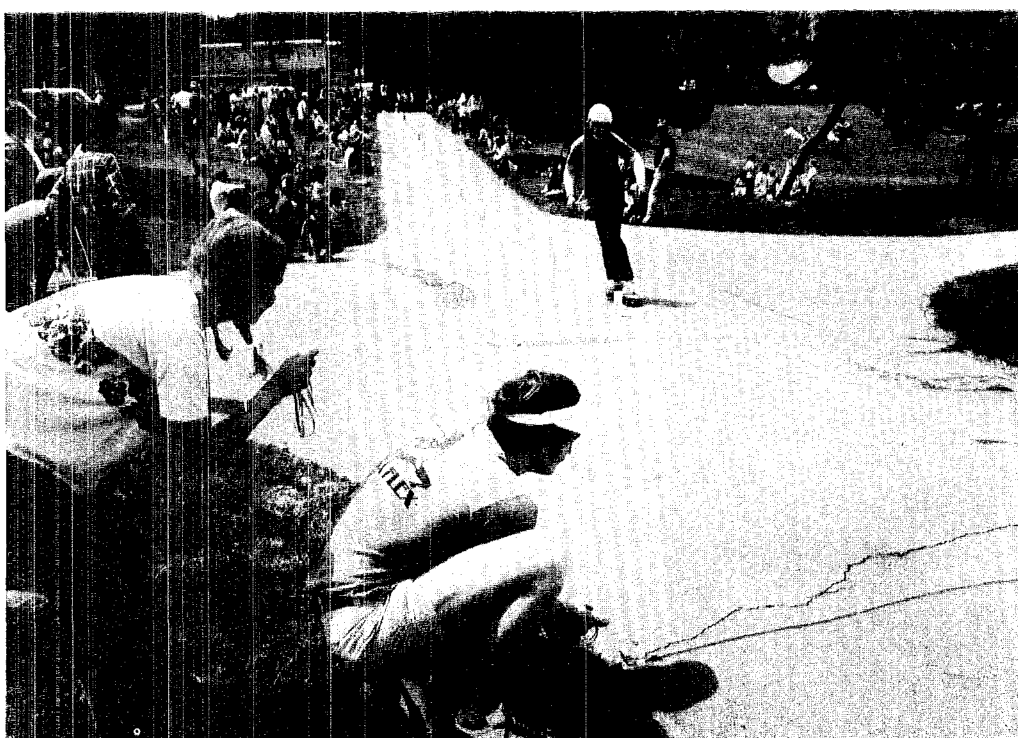


One tail too many on this desert spiny lizard attracted the attention of Ray Maestas, P-11, and Bill Cruise, WX-8, who captured the 3-inch adult male reptile and asked Wayne Hanson, H-8, for an explanation. According to Hanson, the species, which abounds in the Southwest, has the ability to voluntarily shed its tail when attacked—a phenomenon called autotomy. The wiggling separated tail may then distract the predator, allowing the lizard to escape. Later, the lizard grows a replacement tail. This lizard did not completely shed its old tail during some bygone attack, and the new tail grew along side the old one—a not uncommon occurrence. The lizard has been returned to Maestas and Cruise, who are keeping it as a somewhat unusual pet.

Darrel Hohner, ENG-14 construction inspector, inspects a chamber for an HEPA (High Efficiency Particulate Air) filter at the new *plutonium facility* under construction on Pajarito Road. Built to upgraded criteria established following a near-disasterous fire at a plutonium handling facility at Rocky Flats, Colorado, in 1969, the facility will be fireproof and built to withstand severe earthquake and tornado forces that have never occurred in Los Alamos and for which the likelihood of them ever occurring is extremely remote.



On Sunday, April 25, some 40 youngsters showed up at Urban Park in Los Alamos to compete in a skateboard contest starting at 1 p.m. After signing up for 3 events—slalom, relay, and freestyle—the kids donned safety helmets and went at it. Some negotiated the slalom with aplomb, such as Tim Seay, above left, and Bobby Velasco, above right. Others, like Vaughn Croteau, above center, had to scramble to keep their balance as their skateboards scooted out from under them. Some skateboards come in functional surfboard-like shapes, others show whimsical humor such as the one below left. Officially timing the contestants, below right, is Richard Whipple, CNC-11, kneeling, with assistance from Margi Stolpe behind him. Some $100 in prizes were later awarded.



High-school students from Ojo Caliente, N.M., listen to Dale Collier, summer student, H-7, explain waste disposal technology at TA-50, above left. Above right, Jim Griffin, H-5, talks about respirators to Colorado Springs, Colo., visitors. Below left, Topeka, Kan., teenagers look at a solar panel being tested under artificial light. Below right, students from Monte Vista and Cherry Creek, Colo., visit the test reactor at Omega Site.

Youth and Spring

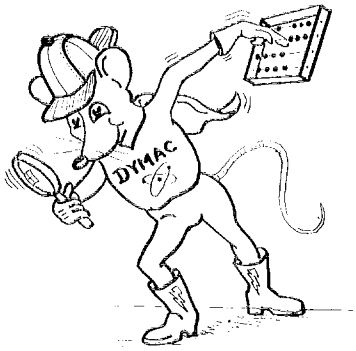
Spring is traditionally the special season for the young. Associated with spring in Los Alamos, as surely as the blooming of forsythia, is the annual visit of high school students for Science Youth Days, an event sponsored by the Thomas A. Edison Foundation.

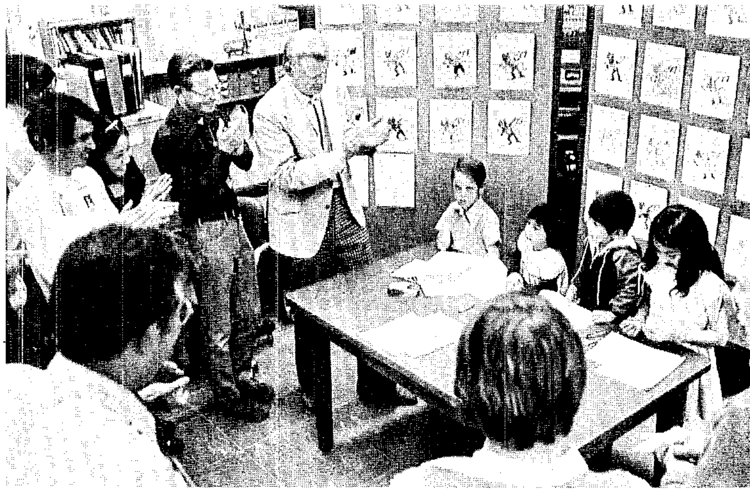
This year, the 19th in which the event has been held, some 600 students from neighboring New Mexico communities and from cities as distant as Topeka, Kansas, and Phoenix, Arizona, arrived by bus early in the mornings of April 22 and 23. (On April 21, Los Alamos High students had made their visits.) Harold Agnew, Director, and Richard Taschek, associate director for research, welcomed the students in the Administration Building auditorium. Following presentations by Peter Gram, MP-4, on the Clinton P. Anderson Los Alamos Meson Physics Facility; Roland Pettitt, Q-22, on geothermal energy; and Ernest Brock, L-DOT, on laser-fusion research; the students saw a film on computer color generation and broke for lunch. After lunch, each of the groups visited 3 LASL technical areas.

As usual, it was hard to tell who enjoyed the event more—the students or the LASL employees who willingly gave their time and expertise to make science come alive for their teen-age guests.

And this spring at Los Alamos also saw an unusual event involving a somewhat younger crowd. It all began when Group R-1 held a meeting during which attendees contemplated the Nuclear Safeguards Program symbol, judged that it had become antiquated, and persuaded the program's senior designer, Les Speir, to volunteer his services in designing a new symbol.

Speir's creation was as appropriate as it was light hearted: a mouse wearing a Sherlock Holmes-style deerstalker cap and holding a magnifying glass. An abacus, ancient Chinese computing and accounting device, was in the background. As a final touch, DYMAC was en-





At left, above, coloring goes on through Group R-1's award ceremony, with Yukata Mishima, right, being especially engrossed. Robert Parker, left, and Misuzu Mishima, center, were among the first-place winners. Below, right, Bob Keepin, Group R-1 leader, wearing a light jacket, leads a round of applause for the contestants. Seeming to be keeping a watchful eye on things is the DYMAC mouse, at right above, which the children enjoyed coloring.

at the Laboratory

blazoned on the mouse's shirt. DYMAC stands for Dynamic Materials Accountability and Control, a system developed at LASL for constant monitoring of strategic materials in nuclear processing plants to guard against theft or diversion, and for continuous accountability.

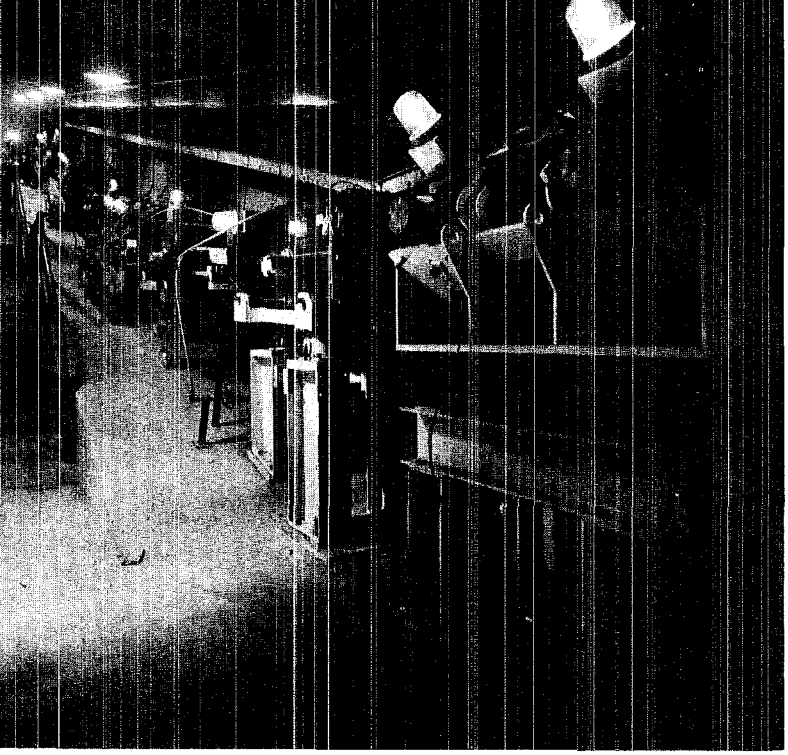
The symbol was accepted, but it was also noted that it lacked one desirable ingredient: color. Why not sponsor a coloring contest among children of Group R-1 employees? The vote was "Aye!"

Some 40 youngsters responded eagerly to Bob Marshall's invitation and the entries poured in. These were judged "blind" by a Group R-1 panel and prize winners were chosen for 4 age-groups.

With due pomp and ceremony at TA-35 on April 1, and with most of the young contestants attending, Bob Keepin, Nuclear Safeguards Program director and Group R-1 leader, presented certificates to the first-place winners: Misuzu Mishima, 2, daughter of Tsuyoshi Mishima; Robert Parker, 5, son of Jack Parker; JiJi Jones, 8, daughter of Dave Jones; and Liz Marshall, 10, daughter of Bob Marshall. However, everyone was a winner as all other participants received honorable-mention certificates.

The presence of Misuzu Mishima in the "winner's circle" gave the contest an international aspect. Her father is a nuclear-fuel fabrication-process designer visiting LASL for a year to study the DYMAC system for the Japanese government. He will help design a safeguards program for a government nuclear-fuel installation at Tokai, near Tokyo, upon his return to his homeland.

The award ceremony was a rousing success with over 20 appreciative R-1 employees attending. So was the contest, judging by the actions of at least one of the children at the ceremony. Yukata Mishima, Misuzu's 4-year old brother, enjoyed coloring the symbols so much that he completely ignored the ceremony, instead became engrossed in coloring DYMAC mice at the rate of 1 every 2 minutes to the amusement of the watching adults.



Above left, the proton beam from LAMPF runs in a tunnel under a road from LAMPF to the WNR. This section is called "the waterfall" because of its descent. Above right, the proton beam, presently ending at "the waterfall," is operated in May for the first time by John Farrell, P-11, seated, as, left to right, Richard Bentley, P-11, Richard Ryder, E-2, and Walter Hatch, P-11, watch.

NEUTRON CITY, U.S.A.

Since English physicist James Chadwick discovered the neutron in 1932, this particle has been of fundamental usefulness as a scientific tool. Having almost the same mass as the proton, the neutron rounded out our knowledge of nuclear structure.

A singular property of the neutron is that, unlike the proton and electron, it has no charge. This allows it to penetrate without resistance the electric fields of atoms, and their nuclei, to interact with them.

Neutrons are the indispensable projectiles that, in the fission process, split nuclei of heavy elements, such as uranium and plutonium. In fission, energy is released as well as more neutrons that sustain the process in a chain reaction. In the fusion process, characteristic of thermonuclear weapons or fusion power reactors of the future, the hydrogen isotopes, tritium and deuterium, fuse to produce energy, releasing neutrons and forming the heavier element helium. In such reactors, neutrons will be the primary transporters of energy, as they interact with lithium surrounding the reaction chamber to produce heat for steam-driven generators.

If neutrons have been important to scientific research everywhere, nowhere has the interest in them been stronger than at the Los Alamos Scientific Laboratory, which pioneered both fission and fusion research. Because it was appreciated that neutrons would be important in the development of atomic weapons, a high priority program at Los Alamos during World War II was the building of the Water Boiler reactor as a neutron source. The need for understanding and manipulating the neutron continued unabated during the post-World War II era, when thermonuclear weapons were being developed, and continues through the present as LASL investigators seek to harness fusion as a source of energy.

Neutrons can be destructive as well as useful. They are a major product of nuclear weapons and are intimately involved in the processes occurring during nuclear explosions. And, although the effect of neutrons at relatively low energies upon materials in present-day fission power plants has been well studied, such is not the case for neutrons at much higher energies in the fusion plants of the future.

Thus, for both basic research and practical application, the need to know about neutrons, their generation and transport, and their action on materials is increasing. In answer to this need, two new and unique facilities, representing a more than $30 million investment in neutron research, are being built at LASL. With existing LASL neutron sources, such as the Omega West reactor and the Van de Graaff accelerator laboratory, the new facilities will make Los Alamos the "Neutron Capital of the World."

A Neutron Machine Gun

The Weapons Neutron Research (WNR) facility, immediately to the south of the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF), will be the first of the new neutron facilities to go on line, in early 1977, according to George Lawrence, P-11 group leader. The building was completed in December 1975, and installation of equipment has been going on since.

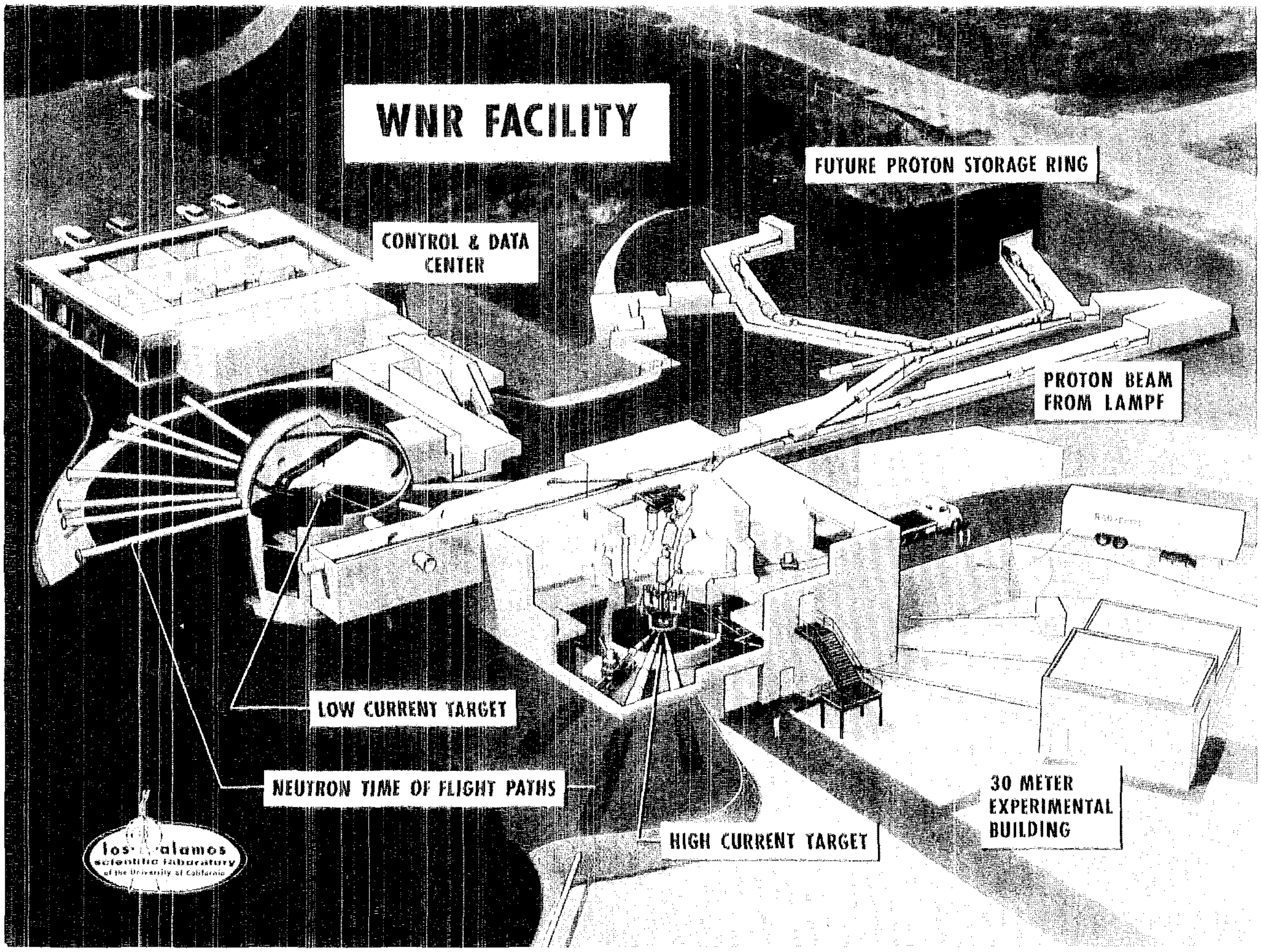
As its name implies, the WNR's basic purpose is for weapons research, although the facility will also be used for nonweapons research as time is available. It will provide experimental checks for the complex weapon design computer codes, and will supply basic nuclear data needed for weapons design. Its special capability is the production of neutrons in very short bursts, for the purpose of measuring effects over an extremely broad spectrum of neutron energies.

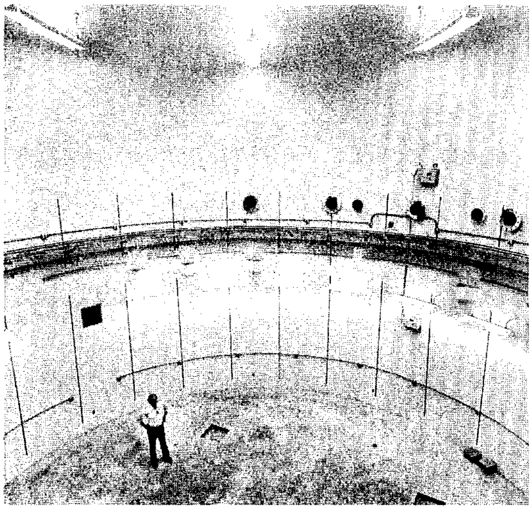
The WNR is an example of efficient usage of existing facilities. From its inception, it was realized that the LAMPF accelerator, producing a high energy proton beam of unprecedented intensity, would be able to produce high fluxes of neutrons over a wide energy range. The WNR facility is attached to LAMPF as if by an umbilical cord. A fraction of the LAMPF proton beam is diverted from the "switchyard," is conveyed through a 150-meter tunnel, and is directed into one of two target areas, where the neutrons are produced. Without this readily available and very suitable source of protons, the WNR would have cost many times its price of $5.6 million.

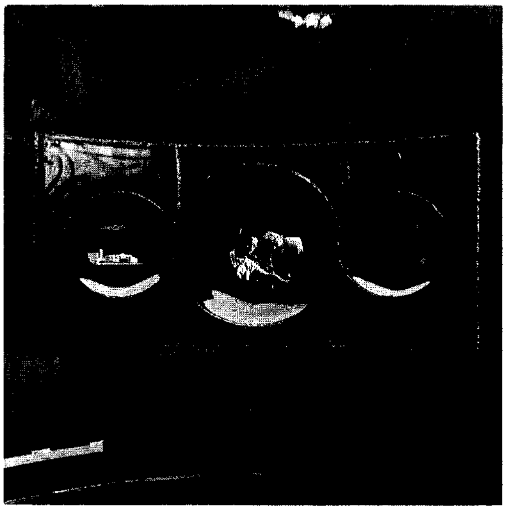
Choppers and Kickers

Proton pulses generated at the LAMPF injector are modified for use at WNR by an electronic "chopper." This opens a gap in the beam near the end of each pulse, which permits a "kicker" magnet in the switchyard to turn on after the main pulse has passed through. The "tail" pulse is then diverted into the WNR beam channel. These tails arrive at the WNR target at the rate of 120 per second, and can be adjusted so that the neutron pulses they produce range in duration from billionths to millionths of a second.

In the primary target area, the protons are directed vertically through a tungsten cylinder (2-4 cm diameter by 15 cm long). In a process called spallation, the tungsten nuclei are fragmented, producing about 12 neutrons for every incident proton. The resulting intense flux of neutrons radiates from the target in all directions. Most are stopped in a 3-meter-thick steel



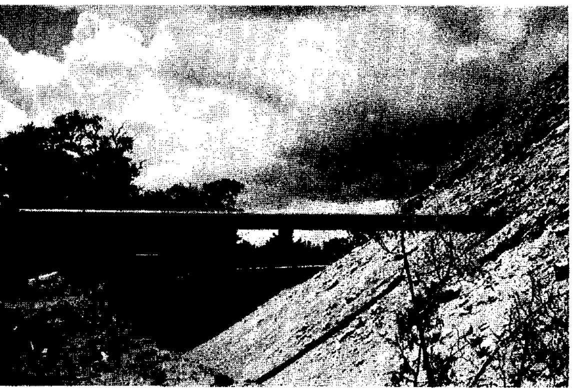




The hot cell above the primary chamber, where neutrons will be produced, here is being inspected by Rex Fluharty, P-11, upper left; John Allen, WX-4, and John Malanify, P-11, on the next lower level; and Jim Lambert, WX-4, and Gary Russell, P-11, on the lowest level. Center, George Lawrence, Group P-11 leader, is dwarfed by the immensity of the blue room, the facility's second experimental area. Right, Malanify and Fluharty are seen through a port of the primary chamber. A time-of-flight tube will later be installed through the port.

radiation shield. However, a fraction of each neutron burst is allowed to pass into flight tubes, which penetrate horizontally into the experimental area beyond the shield like spokes radiating from an axle. Like charges of birdshot from a shotgun, the neutrons travel down flight paths, in which experiments and diagnostic instruments are placed at various points.

The neutrons produced in the tungsten cylinder alone have a wide range of energies, from 10 keV (thousand electron volts) to 30 MeV (million electron volts). If lower energy neutrons are desired, as in basic studies of the properties of matter in bulk, a moderating material (containing a high fraction of hydrogen atoms) can be placed around the central target. The primary neutrons will ricochet within this material, losing energy in the process. With moderators in place, the neutron energies available to experimenters range from 0.03 eV to 10 keV.



Like artillery aimed from a bunker, time-of-flight tubes project from the earth-covered structure of the blue room. These tubes conduct neutrons to various experiments located around the chamber.

As the neutron burst travels down a flight path, the pulse spreads out in time and space due to the differences in velocities between the more energetic and less energetic neutrons. In a typical measurement, reactions produced by neutrons of all energies are recorded; using the relationship between time and distance, investigators can then correlate data collected at a given point in time with neutrons of a particular energy. This is the time-of-flight (TOF) method of energy analysis.

In some experiments, only relatively crude discrimination between different neutron energies is required. Such low-resolution work can be conducted on short flight paths extending a few meters into the main experimental room. Other experiments require very fine separation of neutrons according to energy. Since the further the neutrons travel, the greater the available energy resolution, some flight paths for these experiments extend beyond the experimental building; one is the length of 2 football fields.

Expanding the versatility of the WNR is a secondary target area, dubbed by P-11 the "blue room" because on the original model of the facility it was represented by a block of blue plastic. This area can be employed as a neutron scattering chamber, using neutrons channeled through a tube from the primary source some 20 meters away. Alternatively, low-intensity proton pulses from LAMPF can be switched there permitting neutron time-of-flight measurements to be carried out as a function of angle, and with higher neutron energies than are available in the primary area flight paths.

All this gives experimenters a large choice of neutron intensities and pulse lengths over a wide energy range. However, facility planners would like to produce even shorter and more intense pulses to increase the power of the WNR source. To accomplish this, according to Lawrence, a device known as a proton storage ring would be added to the facility. It would permit enormous increases in the pulsed neutron capability of the WNR, ranging from factors of several hundred to several thousand, depending on neutron energy.

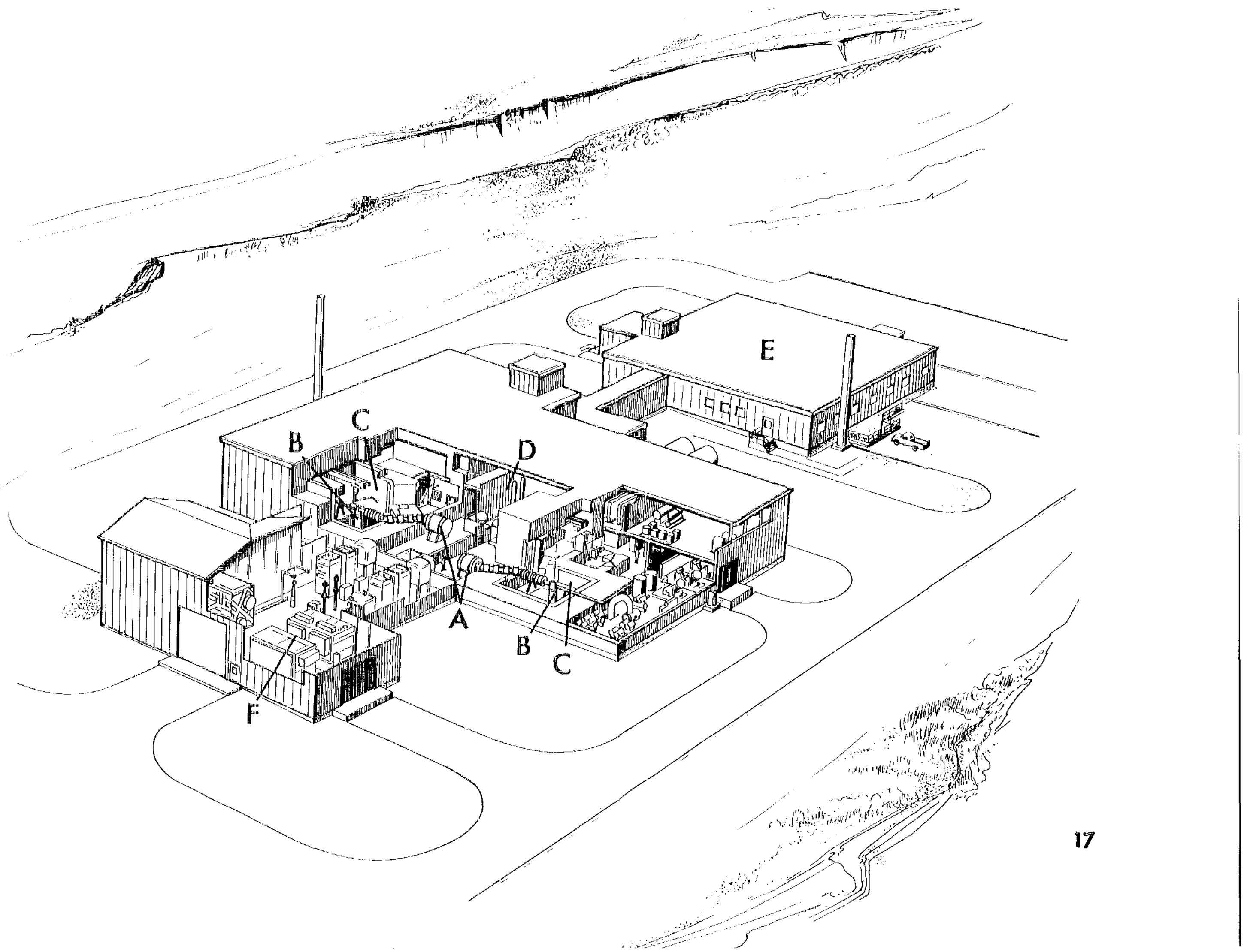
The storage ring is a dream that is being actively pursued by P-11. Planned, but as yet unfunded, it would be a ring of magnets adjoining the WNR proton beam channel. Long LAMPF pulses would be injected into it, whirled about, and compressed greatly in time. Very short, very intense "super" pulses would then be ejected and directed to the primary target chamber, where they would produce neutron bursts of an intensity unprecedented in a laboratory source.

A Steady Neutron Stream

LASL's larger, but more distant (in terms of time), neutron research facility is P-Division's Intense Neutron Source (INS) to be completed in 1980 at a cost of $25 million. An environmental impact statement for this project has been accepted and some coring for the 70,000-square-foot facility has been done on Two Mile Mesa, where the facility will be situated.

In many ways, the INS will remind visitors of LAMPF. Like LAMPF, it will be a "factory," but one which produces neutrons rather than protons and mesons. And like LAMPF, it will be an international research mecca complete with a Users' Group. Already, delegations of scientists from the International Energy Agency have visited Los

The basic components of the planned Intense Neutron Source are shown in the diagram below. A tritium-ion beam, generated at "A," converges with a deuterium stream at "B," producing neutrons in 2 identical cells labelled "C." Tritium is then transported to a separation and recovery room at "D." Building "E" houses a computerized control center, offices, and laboratories. The large amount of power required is generated at "F."



Alamos to consult on design and users' programs.

Conceptually, the facility is completely different from the WNR. Rather than the "machine gun" series of pulses that will be produced at the WNR, allowing neutron experiments at a number of energy levels, the INS will provide a steady flow of neutrons at very high density, but at only one energy: 14 MeV.

By design, this is exactly the same energy at which neutrons will be generated in a fusion reactor. It will allow directly comparable measurements of the punishment that materials will take from neutrons in a full-scale fusion reactor.

But, in addition, the INS will open the door to new understanding of neutron reactions at very high energies and in fluences 100 times greater than any other neutron source planned or in existence, but comparable to those expected in fusion reactor systems. One important task for the INS will be measurements at these high intensities of neutron cross-sections in respect to a number of materials. Cross sections are indices which indicate the probability of a particle entering into interactions with other particles, or nuclei, under given conditions.

One of the more important side benefits of the new INS will be the development of a technology for handling tritium (which is radioactive) safely and economically. Tritium, an unstable isotope of hydrogen with 2 neutrons in its nucleus (ordinary hydrogen has none), will be essential to the functioning of a fusion power plant. Tritium is not now used in magnetic-confinement, laser-fusion, or any type of fusion experiments because present experiments yield desired results without it and because of the costs and complications of handling radioactive materials.

But in generating 14-MeV neutrons at the INS, tritium is essential. Intrinsic to the design of the INS is a closed tritium recovery, separation, storage, and circulation system developed by Bob Sherman and John Bartlit, both Q-26. Its use at the INS will provide a proven technology when fusion power plants are actually built.

The principle for neutron generation at the INS, as first conceived by Dale Henderson, T-6, Harry Dreicer, CTR-DO, and Dennis Colombant, MIT, is being developed by Robert Emigh, P-14 group leader, and is as simple and ingenious in concept as it is intricate and sophisticated in application.

Unlike the WNR, where the neutron-generating target is stationary and solid, the target for the INS is a gaseous deuterium stream moving at supersonic speeds. Deuterium is the stable isotope of hydrogen (with 1 neutron in the nucleus), which occurs naturally as 1 part in 6500 in water and which will be the virtually limitless supply of fuel for fusion power.

High pressure forces the deuterium target to move very rapidly, and the stream is further accelerated by an expansion nozzle to 6 times the speed of sound.

At the point where neutrons are to be generated, this fast-moving stream will converge with a beam of tritium ions (atoms from which the electrons have been stripped). The reaction is hot, compressed, and violent. Within a region no bigger than the eraser on a pencil, a tremendous flux of 14-MeV neutrons will be produced at the rate of 1 thousand trillion every second.

Left, Roy Haarman and Rae Ridlon, both P-14, adjust power-supply equipment being tested for the INS in the Physics Building. Center, a "crowbar," which acts like a fuse, arcs to protect power supply from overload. Right, Karl Meier, P-14, simulates shock waves anticipated in the INS's expansion nozzle by jets channeled in a water bed.

Solid concrete walls 10 feet thick in the source cell are required to shield against the deluge.

The expansion nozzle, designed by Michael Cline, T-3, Karl Meier, P-14, and Emigh, performs other essential functions. The supersonic movement of the deuterium stream through it helps maintain the high vacuum required for the tritium ion beam and helps remove the tremendous heat generated.

In conducting experiments, sample materials will be placed in close proximity to the intense neutron source and effects measured over various periods. "Prolonged and intense exposure to high-energy neutrons in some experiments will considerably shorten the time needed to determine effects compared to the time the same material might require in a fusion reactor. Even so, some materials will require exposures of a year or more," explains Emigh, whose group will operate the facility. "But the greatest benefit is the savings in time and money. It would cause unacceptable delays and costs to wait until a fusion reactor is built to learn how well the materials in it will stand up."

To accommodate the heavy volume of experiments anticipated, 2 identical reaction chambers will be built in the 2-story facility. Like the WNR, it will have remotely operated equipment for manipulating targets and other tasks, hot cells, and elaborate shielding and safeguards. The computer control center will be in an adjacent building, along with offices and laboratories. A third attached building will house the special power generating equipment required.

While the INS is still largely in the engineering stage, work has also taken more tangible form. Roy Haarman, Rae Ridlon, Lloyd Catlin, and Jake Salazar, all P-14, and Jesus Martinez, SP-4, recently flew to Kwajalein to inspect and arrange for the shipping of surplus power supply equipment, which is scheduled to arrive at Los Alamos early this summer. Other equipment like it, acquired from the White Sands Missile Range, is now being tested and refurbished in the old Cyclotron room in the Physics Building.

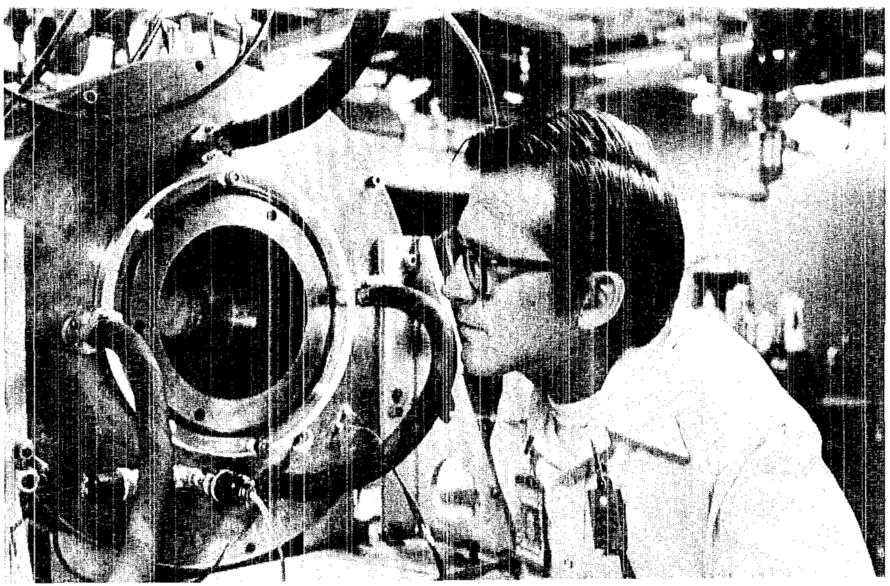
Tests of the vital expansion nozzle have been conducted by Meier using both hydrogen gas jets and simulation. For simulation, high-speed jets of water are directed into a shallow water bed whose sides duplicate the shape of the nozzle. The sharply defined wave patterns so formed indicate the pattern of shock waves that will be formed by a gas target moving through the nozzle at Mach-6 speeds. And at TA-46, Dave Schneider, P-14, has been assembling and testing other vital prototype components for INS, such as a powerful source for producing 1 ampere of tritium ions.

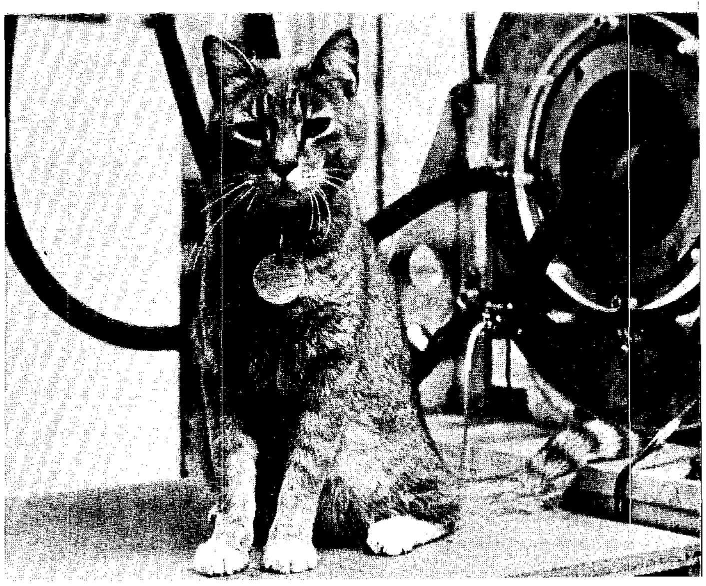
When the INS goes on line in 1980, some 50 LASL employees will operate it around the clock to help the U.S. Energy Research and Development Administration complete a demonstration fusion power plant by 1997.

Particles in Any Size, Shape, Form

A common denominator of much modern nuclear research is the directing of particles at targets and measuring the reactions. Adding what will be the most advanced and versatile neutron sources to LASL's already impressive "inventory of particle generators" will advance the frontiers of science and bring the day of fusion power closer to reality.

Lloyd Catlin, P-14, watches the glow discharge within a chamber being tested as a tritium-ion source for the INS as "Needless," the cat, watches with curiosity but no deep understanding. "Needless" is a functional part of the facility, serving as a mouse remover.





Figuring out how to assemble anode pins for Group L-7 are, left to right and standing, Peter Scott and Bob Zee, both L-7, Frank Lovato, Sheltered Workshop Director, and Doug West, his assistant. Trainees at work are Bruce Blankenship, Lourdes Tapia, and Barbara Gordon.

A Special Kind of LASL Supplier

There are things you expect to find at the Los Alamos Sheltered Workshop and things you don't.

What you expect to find, and do, are love, understanding, professionalism, and a contented atmosphere in which some 20 mentally retarded trainees find fulfillment in doing simple work well.

What you don't expect to find, but do, are production engineering, business management, and a public-relations awareness that would do credit to any small manufacturing company. As a result, the Sheltered Workshop has been a successful bidder for manufacturing a number of miscellaneous items for the Los Alamos Scientific Laboratory. In recent months, the Sheltered Workshop has been awarded LASL contracts at the rate of about 1 a month.

Although LASL's Supply and Property Department had placed occasional orders with the Sheltered Workshop since the Workshop was founded 5 years ago, business picked up noticeably for the Workshop after its director, Frank Lovato, practiced public relations and invited a sizable group of LASL employees to an open house earlier this year. At the open house, the LASL guests were given a guided tour, which didn't last long as there are only 2 classroom-size workrooms to see, and were shown a film, which took somewhat longer, explaining the Sheltered Workshop program.

The open house gave the LASL group a clearer picture of the Sheltered Workshop's purpose, method of operation, and capabilities. "I was very favorably impressed and, as far as I can tell, so was everyone else," says Elza Armstrong, SP-10 group leader. Other visitors from Group SP-10 were Jim Sahling, assistant group leader, and Jack Deveneau. Guests from SP-11 were Arnold Nereson, group leader, Eppie Trujillo, and Fred

Kuhn. Also present were Newby Ellington, SP-DO; Ed Riggs, SD-DO; and C. P. Gutierrez, LASL equal opportunity officer.

In general, LASL awards contracts to the Sheltered Workshop for special items or work that most private industry would find impractical or unprofitable to handle, such as for making nosewipers of rolled filter paper for group H-1 (health physics) and firing tables for group M-4, which tests weapons components.

Lovato recalls the firing-table order with wry amusement. "We really built some fine 4-foot by 4-foot wood tables for M-4," he recollects. "We glued and screwed them so that they would support an elephant, and our trainees carefully rounded the corners and hand-sanded them. After we had delivered them, we learned that the tables are blown up during tests and that there was no need to build them like fine furniture."

Like any business, the Sheltered Workshop can "pull a boo-boo." "We thought we had an order for 100 shot boards for M-2. These are just 15¼- by 30-inch pieces of ⅝-inch plywood with pencil lines that they use to line up equipment in field testing. Our trainees really pitched in and got the job out fast. Then we learned that we didn't get the order after all. Someone quoted a price less than the cost of the materials—they must have had some plywood they couldn't use or sell. Anyhow, we learned the hard way not to buy materials and start production until we were sure we really had the order."

But the successes far outnumber the "boo-boos." In April, the Sheltered Workshop was awarded a contract to assemble 4,000 anode pins used in L-Division's laser amplifiers. Resistors and other materials were furnished and the trainees assembled the pins in 5 stages.

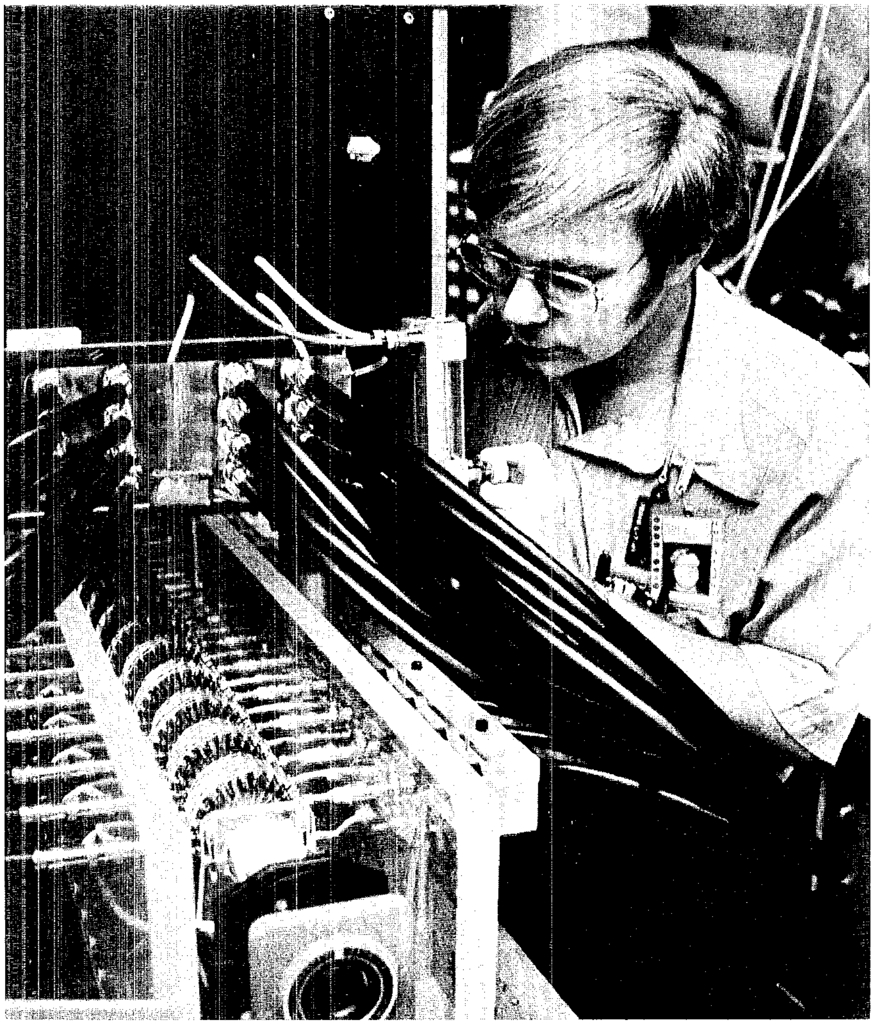
First, the 2 wires of the resistors had to be trimmed to exact lengths of 1/8 and 5/16 inches. For 2,000 of the pins, the resistors had to be inserted into the hollow end of a gold anode and crimped (no resistors were required in the other 2,000). Terminals were attached to one end. Finally, scrap wire remaining from the first trimming had to be cut to an exact length and attached to the other end, along with a second terminal.

This would have been more than a routine task for a normal small industrial plant. That the Sheltered Workshop completed it in only 7 days with part-time trainees is remarkable, especially when one notes that neither Lovato, Doug West, the Workshop's assistant director, nor the Workshop's 2 part-time instructors, Louise Wheeler and Janice Usner, have any previous industrial engineering or production experience.

"The trick is to make jigs so that our trainees don't have to measure anything and can do things repetitively in very simple ways," Lovato explains. "For instance, for cutting the wires of the resistors, we drilled a row of holes through a long board, then counterbored them to an exact depth. The trainees simply dropped the resistors into the holes so that the wires were sticking out from the bottom and the top. Then, when they cut them, the lengths were correct.

"We ran into a problem, though, when we started production," Lo-

Scott examines a laser amplifier with anode pins installed which is now "at home" in a laser laboratory. Sheltered Workshop trainees completed the difficult assembly in 7 days.



vato adds. "The resistors would sometimes bob up in the hole as the trainees tried to cut the wires underneath. Then, one of our trainees suggested making a lid with holes to fit on top after the resistors were inserted. It worked fine, and in addition, it allowed turning the board over so that the trainees could cut the bottom wires faster and more easily.

"I only mention this to show that practically all mentally retarded persons have some sort of capability. We look for that. The trainee who suggested this idea obviously has the capacity to both comprehend a mechanical problem and come up with a solution."

Ingenious tools and jigs abound in the workrooms. A jig for making locating rings for Group M-2 was particularly difficult to make and use, since the specifications called for a cutout of a 280-mm-diameter circle with zero tolerance on the inside and only 1 millimeter on the outside. "We really had to sweat to get the jig just right and then use it in a very precise way. But our trainees did it. Sometimes their ability to do very accurate work surprises even us," Lovato comments.

Most jobs, however, are not so demanding. For instance, phenolic tops for isolation-resistor containers for CTR-Division's Scyllac experiment had to be drilled for wires. The location of the holes was not critical, so it didn't matter that the holes in the jig had become somewhat eroded and enlarged by constant drilling. Some trainees can use power tools competently and safely, and those trainees used a drill press and a band saw to make the tops.

When not occupied in performing work for LASL and other customers, the trainees make wooden toys and rugs, weave, or participate in other Sheltered Workshop activities. "We take them on field trips, several times a year. And they all train for and participate in our athletic program," Lovato says.

The Sheltered Workshop program is tied to the national and international Special Olympics program, which sponsors and organizes competition for mentally and physically disadvantaged persons everywhere. "It is the world's largest sports association," Lovato says with a smile. "There's no such thing as not making the team. Competition is set so that there are a number of groups within a given event. Regardless of a person's handicap, he competes only against others of equal ability."

Lourdes Tapia puts finishing touches to a bicentennial rug. One like it was presented to Harold Agnew, Director.

The program is broad in scope; only a few of the riskier events, such as pole vaulting, are absent from field and track meets, and the Special Olympics sponsors programs in swimming and basketball. Trainees at the Los Alamos Sheltered Workshop train regularly for competition with other special-education institutions in New Mexico and participate in regional and national competitions.

While customers, such as LASL, frequently benefit by buying unusual items from the Sheltered Workshop, taxpayers who never deal at all with the Sheltered Workshop also benefit. According to Lovato, it costs about $15,000 a year to care for a patient in a state institution, but only $2,500 a year for a patient living at home and participating in the Los Alamos Sheltered Workshop program.

And there are other benefits to society. Although most trainees remain employed at the workshop (trainees are paid small amounts on an hourly basis), about 30% can learn work habits and skills sufficient to become productive employees in the "outside" world.

But customers and taxpayers alike would agree that the greatest benefits are human and personal. "Except for some impairment in their mental capabilities, usually caused by an infantile disease or a tragedy later in life, these people are just like us in their feelings. They laugh. They cry. They love. They hate. And just like us, they feel recognized and rewarded in doing useful work that they can handle and enjoy. I think you'd see quite a difference between our trainees here and people like them in most state institutions," Lovato says.

A visitor watching a group of trainees busily sanding toys, sometimes chattering happily among themselves, would have to agree.

short subjects

Honors: **Harold Agnew,** Director, has been elected a member of the National Academy of Engineering (NAE) for his "pioneering contributions in weapons engineering and combining science and engineering into effective technology." The NAE sponsors engineering programs aimed at meeting national needs, encourages engineering research, and recognizes distinguished engineers.

Stephen Stoddard, Group CMB-6 leader, has been inducted as the 78th president of the American Ceramic Society. Previous posts with the Society include treasurer and vice president. The Society has 10,000 members in the U.S. and some 80 foreign countries.

Raymond Pollock, TD-Division leader, has been awarded a Special Achievement Award by the U.S. Energy Research and Development Administration's Division of Military Application. Pollock received the honor for his contributions to the ERDA laser isotope separation program.

Donald Dickman, C-3; **Francis Berry,** ISD-7; **Chester Kazek,** C-4; **David Buckner,** C-1; and **Robert Crook,** ISD-7, received the Edward Rosse Award from Comtec, an international computer association, "for their outstanding contributions to the advancement of computer micrographics technology." The plaque was awarded to the group for its pioneering work in computer-generated color film.

Charles Folkner, C-DO, has been elected president of VIM, Inc., an international organization of computer users.

Betty Burnett, Group ISD-4 main library section leader, has been elected president of the Rio Grande Chapter of the Special Libraries Association.

Raphael J. LeBauve, T-2, was presented a certificate of appreciation by the Cross Section Evaluation Working Group at Brookhaven National Laboratory for his 10 consecutive years of service with the group in working towards the improvement of reference nuclear data.

LAMPF passed another milestone in its program to achieve higher intensity operation when a full-energy beam of about 110 microamperes was delivered to the main experimental area on June 1, 1976. The test run lasted for about 2 hours.

The Los Alamos Scientific Laboratory has received approval from the U.S. Energy Research and Development Administration of the Laboratory's Affirmative Action Plan for FY-1976.

This plan is submitted yearly as required by Federal regulations and sets forth positive good faith efforts to be taken over a five-year period.

The Affirmative Action Plan reflects the policy of the Laboratory towards nondiscrimination and equal opportunity in all areas of employment and states that all employees and applicants shall have equal employment opportunity regardless of race, color, religion, sex, marital status, national origin, or age.

Retirements: **Clara Green,** WX-7, detonator technician; **James Marsh,** SD-5, laboratory machinist; **Hugh Paxton,** R-5, staff member; **Lawrence Elmore,** WX-7, senior designer; **Albert Romero,** SD-1, laboratory welder; **Bernard Killoran,** WX-2, mechanical technician; **Luther Rickerson,** SD-4, laboratory inspector; **Alice Sisneros,** WX-7, detonator technician; **John Coleman,** SD-4, laboratory machinist; **William Tynan,** SD-5, laboratory machinist; **Harry Duhamel,** SD-5, laboratory machinist; **Gale Hanks,** CMB-6, staff member.

Hugh Paxton, R-5, is continuing as a member of the U.S. Nuclear Regulatory Commission's Safety and Licensing Board Panel and as a consultant to LASL on nuclear safety following his retirement this May. Paxton joined LASL in 1948 and headed its critical assembly program until 1975. He is a charter member and Fellow of the American Nuclear Society and a Fellow of the American Physical Society.

Deaths: **Mary Curfman,** CTR-7, secretary; **Robert Stoll,** WX-5, staff member; **Leroy Schiller,** ENG-2, senior designer.

Bulletin from Barking Sands:

LASL LAUNCH AVERAGE .500

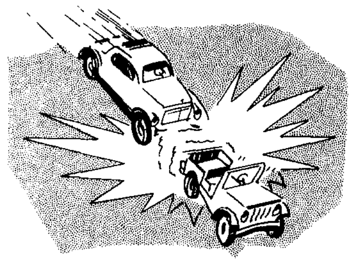
LASL teams involved in 3 rocket launches at the ERDA Test Facility at Barking Sands, Kauai, Hawaii, have chalked up 1 loss and 1 win, with 1 "game" remaining in a hectic "spring series."

On May 14, a launch to acquire new information on a cosmic x-ray source failed when telemetry did not function and the payload's flotation system separated from the payload, which sank at sea. Disappointed Group P-4 investigators were John Laros, Harold Argo, and James Bergey, who had designed and installed, and had planned to monitor, the x-ray measuring instruments.

On May 22, a pre-dawn launch to learn more of cryogenic heat transfer processes in zero or low gravity conditions was successfully completed. A rocket flight to 200 kilometers altitude provided about 5 minutes of free-fall time and yielded data for Ken Williamson, CTR-9, and Fred Edeskuty, James Taylor, and Robert Candler, all Q-26.

As *The Atom* goes to press, a 12-man "Project Buaro" team, headed by Bob Jeffries, Group J-10 leader, was taking the field for another in a series of barium injection probes to study the earth's magnetosphere (*The Atom,* July-August 1975). The team plans to inject 7 times the barium released in any previous probe for the most spectacular nighttime display yet and boost the LASL average to .666.

10 years ago in los alamos



Culled from the May-June, 1966, files of The Atom and the Los Alamos Monitor by Robert Y. Porton

Honors

Norris Bradbury, LASL Director, was presented the Department of Defense Distinguished Service Medal at a ceremony in the Pentagon last week. And, for the second time in four years, LASL had double winners among recipients of the Ernest Orlando Lawrence Memorial Award, which was presented by the AEC in Washington, D.C. Harold Agnew, leader of LASL's Weapons Division, and Ernest Anderson, member of the biophysics staff in H-4, were the Los Alamos winners.

Widening

Trinity Drive, the community's main east-west traffic artery, is being widened to accomodate four lanes of traffic. The work is being done by the Zia Company's subsidiary, Los Alamos Constructors, Inc., accomplishing an improvement that had been deferred for years, pending the removal of Sundt housing.

A New Frontier

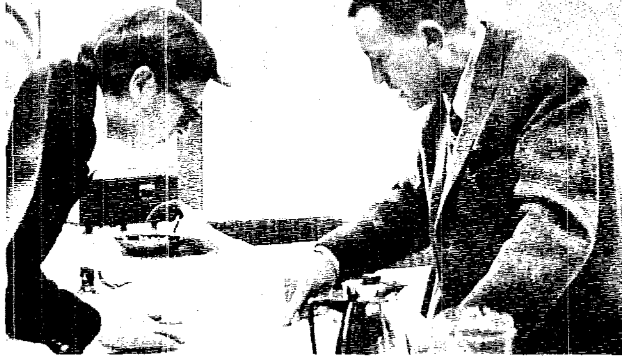
Since medieval times, man has attempted to transform one element into another. On May 5, LASL conducted "Cyclamen" at the Nevada Test Site. This was the most successful heavy element experiment to date involving the use of nuclear explosives. There is evidence to suggest that the experiment, which utilized a device designed by Carson Mark, T-Division leader, and a group of collaborators, produced the heaviest substance yet isolated.

Ouch!

Would you believe FOUR times? The Ed Snows are beginning to feel jinxed and with good reason. Friday afternoon their jeep was hit by a rollaway car. The auto had been left parked in front of a "No Parking This Side Of The Street" sign across and up the street from the Snow residence. The car rolled and struck the Snow vehicle in the rear. Not too unusual in hilly Los Alamos. . . . but this was the second time in two weeks. Earlier this month, their brand new station wagon, parked in an off-street parking pad, was struck broadside by a car which rolled from a yard just up the hill and jumped the curb. Before moving there, the Snows had two new autos damaged by runaway vehicles. "I think I'm through buying new cars," said Snow, with a disgusted look at the banged up jeep.

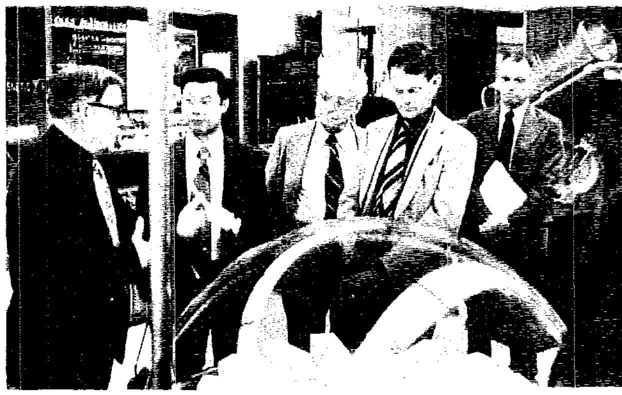
Among Our Guests

On April 21, U.S. Senator Pete Domenici (R-N.M.) visited Los Alamos to inspect the post office, speak at a Rotary luncheon, and conduct a public hearing on roads and housing. Here he chats with Vernon Kerr, H-11, who is also a Republican state representative.



James Schlesinger, presently a teacher and lecturer at Johns Hopkins University and formerly Secretary of Defense and Chairman of the Atomic Energy Commission, gave a "standing room only" colloquium at LASL on April 8 dealing with U.S. defense and foreign policies. Here, seated at Director Harold Agnew's right, he elaborates on his views during a press conference afterward.

On May 7, scientific counsellors and scientific attaches from the embassies of Australia, Belgium, the Republic of China, Finland, Israel, South Africa, and Sweden conferred at LASL to learn more of LASL activities. Here, Bob Brashear, ISD-2, explains a model of Scyllac to Kwang Shen Wu, Republic of China; Louis Groven, Belgium; Lars Ortegren, Sweden; and E. G. Bowen, Australia, in the Norris E. Bradbury Hall of Science.



Two Iranian nuclear officials visited LASL April 23-24 for briefings on many phases of LASL's research programs. At DP-East, William Maraman, Group CMB-11 leader, left, and Richard Baker, CMB-Division leader, back to camera, explain plutonium handling to Mojtada Taherzadeh, director of the Nuclear Institute at Teheran, center, and Akbar Etemad, president of the National Iranian Atomic Energy Commission, right.

A few of the 100 students from 14 universities who are members of the American Nuclear Society Western Student Conference and who visited LASL on April 2 for tours and conferences, here listen to Dennis Roeder, MP-7, explain features of LAMPF. On the following day, the group went to Albuquerque for a nuclear forum.

Summertime and the living is easy. This tranquil scene of Ashley Pond taken by Bill Jack Rodgers, ISD-1, sums up the special pleasures of life at Los Alamos during green summer months.